Engineering Record

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Construction More Active

STEADILY, but quietly, increased activity in the construction field is becoming manifest. The increase in the Contracting News section of the Engineering Record to almost twice the usual number of pages, the several columns of personal notes—most of them changes in position or new appointments—and the increasing number of "Positions Vacant" items in the advertising section are significant reflections of the developments that are taking place. There is food for both optimism and serious thinking in respect to renewed activity along construction lines. The labor problem, due to restricted immigration, may be acute. Machines must be found to do the work of men in every possible task. The outlook for the no-plant contractor is not bright.

Florida's Road Department

BY a recent decision of the Florida Supreme Court, the validity of the legislative act creating a state road department and providing for its expenses has been established. There is now no obstacle to prevent the department from proceeding with its work and the appointment of the salaried commissioner authorized by the act. That the state will be benefited greatly cannot be doubted. The good roads spirit in Florida is well developed. An unusual element in the public addresses at conventions and other gatherings is the consideration given to the tourist. It is not only for the convenience of the citizens of the state that good roads are urged, but for the transients that come and go, for it is well known among those who think that the tourist is a large factor in Florida's prosperity. The promoters of the movement have succeeded in convincing the general public of the tourist's value to the extent that it is willing to spend money not only to improve the roads, but to beautify them as well.

Neglect of Bridge Maintenance

WHEN a steel highway bridge located where many people cross it every day is allowed to deteriorate through corrosion of the main members until final failure occurs when fully loaded with electric cars and human lives, there is pressed home once more the fact that criminal negligence and thoughtless taking of chances too often mark city administrations in this country. Fortunately, in the case of the pony-truss span failure in Johnstown, Pa., reported in the news section of last week's issue, no loss of life resulted. If the span had not settled so gradually and remained practically in a vertical position without overturning, the human sacrifice would have been sufficiently impressive to have startled even the politicians. The present city engineer, it is reported, had recently condemned this bridge, among others in Johnstown, and asked for an appropriation for repairs. As usual, nothing had been done. In the Johnstown bridge a main diagonal web member had rusted away near the timber floor until only about one-sixth of the original section remained. This member, an end diagonal, probably failed first and the badly corroded chords, unable to carry the added strains, soon followed. In addition to lack of painting and proper inspection, another simple and well-known precaution in laying the timber flooring to prevent corrosion was neglected. At least 1 in. clearance should have been provided around the steel to avoid water pockets and allow the use of a paint brush. Furthermore, the bridge was originally designed with duplicate trusses and cantilever sidewalk on one side only, without provision for trolley tracks on the roadway. When the single track was laid it was located (with great engineering wisdom) next to the truss carrying the sidewalk load. The most simple and elementary requirements of maintenance and inspection appear to have been entirely neglected.

Flood Lesson at Rochester

WHILE last week's flood of the Genesee River at Rochester, N. Y., did not duplicate, in loss of life and property damage, the catastrophe of the Ohio Valley in 1913, it established a new high-water record for that vicinity which is highly significant in the lesson it should teach. The moral is forcefully presented by James P. Wells in his analysis of the local situation on page 476 of this issue. The sudden melting of the deep blanket of snow which covered the Genesee watershed was responsible for the unprecedented rise in the river. The peak of this year's flood is estimated at 50,000 sec.-ft. as compared with the largest previous volume of 45,000 sec.-ft. recorded in 1913. The swollen stream, passing through the city center and encountering obstructions in the way of bridge piers, canal crossings, etc., inundated streets and railway tracks, undermined pavements, flooded cellars and caused about $300,000 worth of damage. Luckily the rise in temperature which caused the snow to melt was not accompanied by any heavy rainfall. To this happy combination of circumstances Rochester can attribute her escape from what might well have been a calamity. But it is entirely possible that a spring thaw and a severe rainstorm might occur simultaneously. In fact, in March, 1913, a precipitation of 5 in. was recorded. If a similar amount of rain had fallen last month to augment the runoff from the snow it is estimated that a 100,000 sec.-ft. flood would have resulted, causing a repetition of the scenes at Dayton and Columbus three years ago. Surely these facts should impress upon the city officials of Rochester the need for proper flood prevention measures. There is an opportunity to forestall a possible future catastrophe by prompt action, based upon expert engineering advice. The point is that such action, after the next flood, will be of little avail. Now is the time to take this year's lesson to heart.

Course in Business Economics

ALTHOUGH outside what might be called the technique of engineering, a post-graduate course in business economics, just opened at Harvard University, deserves mention. Leading to the degree of Ph.D., the course requires the usual residence study of about three years, subjects being selected from a group of thirteen titles embracing public finance and taxation, economic history, economics of agriculture, accounting, marketing, foreign trade, industrial management and labor problems, money and banking, transportation, insurance, corporate organization and finance, and statistical method. All candidates for the degree are obliged to take a course in economic theory. The primary intention of the new course is to meet a rising demand from all parts of the country for men who are qualified to teach business, not from the point of view of tradesmen who have strayed into the teacher's chair, but from that of the economist who has learned how economic theory has been tested by application to the concrete problems of modern business. Without question the influence of such instruction will ultimately be felt in the teaching of collateral branches accompanying both undergraduate and advanced courses in engineering in technical institutions, and will contribute to the broadening of the engineer's training by emphasizing the close relationship existing between "pure" economics and present-day business.

The Shields Bill

FOR years this journal has been urging the need for federal legislation which would encourage the rapid development of our wasting water powers. As is well known the only form of permit which can be secured now is revocable at any time. Under this provision capital has been deterred from water-power investment. So patent is the present unfavorable situation, so apparent is it that true conservation demands the utilization of energy now being wasted, that the demand for suitable legislation is heard from every quarter. Year after year measures have been introduced. Much time has been consumed in hearings, yet always the pressure of legislation has resulted in the measures dying with the termination of the sessions. In the fall of 1913 the National Conservation Congress met in Washington to discuss the question. The water-power committee brought in not only majority and minority reports but also a set of "unanimous recommendations," which had the support of the entire committee. These recommendations, too, were the burden of the majority and minority reports, which differed from each other and from the "unanimous recommendations" in minor respect only—and chiefly in the emphasis which the minority report laid on the danger of water-power monopoly. An examination of the Shields bill, side by side with these recommendations, shows that each of them has been embodied in the Shields bill, save only that which provides that the government should reserve the right of receiving a compensation for the power granted. It is the omission of such a reservation which has brought forth the chief opposition to the measure. As to this matter there is ground for argument. The only reason for demanding such a clause is that the state public-service commissions, to which the bill gives the right of regulating intrastate rates, might be subservient to the wishes of the water-power companies. Rates might thus be set which would fail to return to the public its share of the water-power benefits. With our present experience in regulation, however, the danger is rather that the attitude of the commissions toward the companies will be inimical. Where power is transmitted across state boundaries the Interstate Commerce Commission would control the rates. The real injustice to the public would come, in the opinion of this journal, in cases where a power was granted for the use, exclusively or in large part, of a single industry. And this would apply whether the industry received the grant directly or through a subsidiary. Where a power is so granted, the company may get an inordinate return and the public nothing. There should be a clause in the bill, therefore, which would allow the government to lay a tax on that part of the power used by a grantee-proprietor whenever power so used exceeds 40 per cent of the total generated. With this addition the Shields bill should meet the hearty approval of thinking citizens. So amended it would adequately protect the interests of the public, and make it possible to attract investors. The bill should then receive favorable action in the House.

"With the Greatest Possible Frankness"

IN ITS issue of March 18, page 377, the Engineering Record published an editorial discussion of a communication addressed by a past president of the American Society of Civil Engineers to the local associations of that body. Certain grievous errors were pointed out. The past president in question was Col. John A. Ockerson. He has now, following word from this journal that it would print his comment on the editorial referred to above, sent a discussion which appears on page 490 of this issue.

The Engineering Record has printed letters from quite a number of members of the society opposing the removal plan. It has refrained from commenting on them, holding that it was well that both sides be given presentation. But when statements are not in accordance with the facts and are calculated to influence quite a number of members, this journal feels itself obligated to point out the errors. It does so in pursuance with Colonel Ockerson's own declared wish that the matter be discussed "with the greatest possible frankness."

Colonel Ockerson persists in reiterating the view expressed in his letter to the local associations as to the relation which would exist, should removal be determined upon, between the American Society of Civil Engineers and United Engineering Society. He argues that the United Engineering Society has "other functions" because it issued the invitation to the civil engineers to join in the use of the Thirty-ninth Street building. This is not an "other function." It is *the* function for which the united body was organized—to own and manage the building. The American Society of Civil Engineers was to be invited to use the structure. Who but the United Engineering Society, the owner and manager of that building, could have issued the invitation?

Colonel Ockerson shifts the argument when he infers that merger is intended because of what correspondents of the Engineering Record have said. His communication to the local associations stated unequivocally that the American Society of Civil Engineers would in public matters become subordinate to the United Engineering Society. That some persons hope that such will be the case does not affect the fact that under the charter and the founders' agreement such is *not* the case. Moreover, the national societies of electrical, mechanical and mining engineers have been in the Engineering Societies' Building for nearly ten years, without surrendering any of their rights or their autonomy (except as to housing) to the United Engineering Society. Yet, despite this ten-year record, Colonel Ockerson holds that this maintenance of autonomy is merely the Engineering Record's opinion.

The letter, too, indicates a failure to understand clearly the relation between the United Engineering Society and the Engineering Foundation. While the latter was organized under the auspices of the United Engineering Society, the management of the two organizations is separate. Moreover, the societies which are members of the United society do not by themselves manage the Engineering Foundation. The American Society of Civil Engineers and even the general public are represented on the board of management.

On the matter of operating costs, Colonel Ockerson's figures are undoubtedly those which the committee of the board of direction had in mind in presenting the plan to the membership. The Engineering Record's former criticism in this connection, therefore, does not hold. Yet knowing that the figure in question is $2,511, or even $3,711, the Engineering Record is ready to join with the committee of the board of direction in the opinion that this is not a "material difference" when a matter of such moment is involved.

With Colonel Ockerson, this journal agrees that the subject should receive full discussion and that it should be viewed "with the greatest possible frankness." With this object solely in view it has believed it necessary to point out the very apparent error in Colonel Ockerson's position.

Optical Determination of Stress

JUST a hundred years ago Sir David Brewster, one of the great masters of physical experimentation, discovered that transparent materials become double refracting under stress, and having a singularly practical mind he suggested that the stresses in bridge arches could be rendered visible and studied by making a glass model and examining it in polarized light. The suggestion lay unutilized for many years, but not long ago it was taken up abroad and put to practical use. In fact a French engineer has recently studied a glass model of a proposed reinforced-concrete bridge and applied the data obtained in an arch of more than 300-ft. span. In the hands of several English engineers the work has been carried even further, so that it is now possible to obtain not only general but specific and quantitative information regarding the effects of strain in structures and machine parts of very varying character. Glass being somewhat inconvenient to use and work, xylonite, which can be readily formed into shape, has been adopted as the best material.

The principle is very simple, being merely to form a model of the thing to be investigated in xylonite and then to examine it by polarized light, loading it or applying stresses in various directions corresponding to those for which it is designed. When the material is under no strain the apparatus is so set up that it is opaque to polarized light. On applying load the internal stresses appear first in faint luminous bands and then in bands regularly varying in color as the stresses are increased, showing the exact effects produced in various parts of the model by thrusts or tensions or twists applied in the desired directions. Even the unaided eye can give a fairly good account of the situation, while if more exact measurements are desired the stresses shown at any particular point can be compensated by the application to a similar member of a stress working at right angles to the first until the effect of the former is neutralized. The result of change of section in beams can be thus very readily examined and the numerical results obtained in this simple way are found to check excellently with those derived from ordinary mechanical experiments on similar forms.

Many cases of the distribution of stresses in structures can be examined mathematically, but as the situation grows more complicated analysis is increasingly difficult and finally, in dealing with complex forms, predetermination becomes extremely difficult if not impossible. By testing models optically a good idea can be quickly obtained of the situation even in the most intricate cases, since the distribution of the strains due to service can be imitated with considerable precision. Among the mechanical problems which have been studied in this way are, for example, the stresses in a pipe under high pressure, showing the heavy stresses at the interior surface, falling off in a perfectly definite way as the exterior is approached, a case which is, of course, quite computable. An examination of the effects of rivets is, however, by no means so easy from the theoretical standpoint, yet the models show it at once and when the optical data are combined with those obtained with the lateral extensometer the principal stresses can be obtained with a very gratifying degree of precision. Again the configuration of irregular parts of machines to produce the most favorable stress conditions can be very quickly found and it is even practicable, starting with a model, to cut it down until the stress conditions become satisfactory and then to apply the data thus obtained to the actual structural material, of which the mechanical characteristics are, of course, very well known. In cases where extreme lightness is necessary and one has to work with reduced factors of safety, an experimental study of models by the optical method is likely to give important information.

The whole matter has been referred to before in these columns, but its progress has been rather rapid, and engineers who are working upon nice problems of mechanical design would do well to follow up the literature of the subject, which is mostly to be found in the English journals, and take advantage of the facilities for investigation offered by this method of rapid analysis.

The Daily Press and the Engineer

TOO OFTEN engineers give expression to a feeling of resentment toward the daily newspapers because engineering subjects are not treated as their importance justifies. That the feeling is not warranted in many cases and that the editors are anxious to present live, technical information to their readers, was well illustrated a few weeks ago by a heart-to-heart talk between James Keeley, editor of the *Chicago-Herald*, and the members of the Chicago Trade Press Association. He clearly indicated that he saw the need of and wanted to print trade and technical news. The material, however, must be furnished in the right shape. Engineers are not accustomed to put very much information in 300 words, but that was Mr. Keeley's specification as to length. No doubt the necessity for brevity, coupled with the inability of the newspaper staff to condense a really meritorious engineering news story into 300 words, accounts for the relatively small amount of such material handled by the larger newspapers. It was the first time a metropolitan newspaper editor had met with the trade and technical publishers to discuss such a topic and the outcome means much for the fields they represent.

Newspapers in smaller towns are not so cramped for space and the *modus operandi* of getting engineering matter into them is a much easier problem. The editors of the smaller cities also are alive to the engineer's value. The *Minneapolis Journal*, for instance, recently reprinted from the *Memphis Commercial Appeal* an editorial on the necessity of giving engineers the money and unhampered authority to solve the Mississippi levee problem.

Much advice has been given as to just how to get engineering publicity, but it all comes back to the fact that publicity is a commodity and must be paid for. Some one must compress the 3000-word story into the 300-word paragraph. The compression costs something, but it is worth the cost.

After the War

IT may be premature to consider the possibilities at the end of the present world's conflict, for it is yet far from ceasing. Still, the attainment of peace seems not wholly beyond the horizon, and one must look forward to the time when fifteen million men or so return to the occupations of peace. The problem of dealing with the industrial situation which will then arise is enough to appall the most optimistic of political economists. The whole production of the world will have to be reorganized, since it must be turned from the necessities of war to those of peace in the shortest possible time. Every nation now in the struggle will emerge from it with a terrible load of debt and an inevitable burden of taxation, hard to stagger under even in the most prosperous times. It will be necessary then to mobilize all the forces of industry, all the resources of engineering and manufactures, to begin to make good the damage which has been done.

Ordinarily there is a certain stimulating period of enthusiastic relief which follows war and gives an impulse to this work of organization. The great task of finding work for the returning soldiers must be planned long in advance in order that the sudden change in conditions may not bring complete, even if temporary, demoralization. The situation is rendered all the worse by the millions of cripples who must be given opportunity to earn a living. There will be, of necessity, great political changes, here and there, perhaps, of a very revolutionary character. The great question as to whether the relations of the state and the citizen do not demand that the powers of the former shall be marshalled to give a chance for honest labor to the latter, will arise with a new and imminent insistence. No economist yet has been able to furnish an adequate answer, except under imposed conditions which may actually have passed out of existence in the present world upheaval

From the standpoint of the American the problem is less acute, but it must be pointed out that when the war ends our country will confront a situation unique in its political and industrial history, less menacing than that abroad, but certainly to be given the gravest consideration. In the first place, this country has recently passed through a period of some depression, later built up, perhaps, into an ephemeral prosperity by the enormous amount of manufactures and exports directly or indirectly resulting from the removal of fifteen or twenty million Europeans from the field of productive labor. This particular sort of prosperity must necessarily terminate with the war. Even now the slightest rumor of peace sends a certain group of stocks downward, and the great factories all over the country, which are working overtime, even twenty-four hours a day, on war orders, must look forward to a sudden cessation of activities, a dropping back to normal or less than normal output, except in so far as our own necessary and sorely needed preparations for defense may serve for a time to soften the shock. The certain results will be, merely for the reasons already mentioned, acute labor troubles, the undoubted reduction of war wages, and superimposed on this the most violent of competition from the European nations striving desperately to employ their men.

It is perfectly safe to say that every factory now left standing will be pushed into work, and the several governments will probably be driven to extraordinary measures of aid to encourage shattered capital and demoralized labor into an alliance for their mutual safety. This again reacts on the industrial situation here, of which a still more serious phase is extremely likely to appear in the suddent onset of a great wave of immigration from countries sorely burdened with taxes and offering but slight inducements to the laborer. However complacently one may look at the good results of the immigration in the first half of the nineteenth century, he must sorrowfully admit that the additions of the second half were relatively less valuable, ultimately ending in abnormal increase in unskilled labor which has had a somewhat demoralizing result on industry. At the present time it is perfectly clear, whatever views one may have about immigration, that the end of the war will see an army of the unemployed many times greater than any force of soldiery that the United States ever put into the field.

To meet this situation will require the utmost skill and foresight in industrial organization and in statesmanship. It seems almost inevitable that the danger should be met, at least temporarily, by arbitrary barriers to check the predatory onslaught of both goods and labor. It will be no time to let down the bars and invite ferocious competition in manufactures or among those who produce them. The sooner our statesmen awaken to the sense of the responsibility that confronts them and realize that an industrial situation is arising which never has been paralleled in kind or degree in the whole history of the world, the better chance America has of escaping actual disaster. It is idle to speak of precedents derived from the experience of petty wars when manufacture was unorganized and transportation undeveloped. There will be no escape from the most colossal industrial struggle which the imagination can outline, and woe to that country which does not make ready to defend its industrial frontiers.

How Buildings Were Appraised in Revaluation of Real Property of Los Angeles

Requirement That Entire County Be Covered in Ten Months Necessitated Unusual Field and Office Organization and Methods

By J. C. BANNISTER
Building Valuation Engineer, Joint Bureau of Appraisal, Los Angeles

TO OBTAIN an equalization of values of real property throughout the city and county of Los Angeles along the lines of recent study and investigation, a Joint Bureau of Appraisal is just completing a ten months' revaluation of the land and buildings. The work has been done under the general direction of James G. Stafford, superintendent of the bureau. Alexander MacKeigan had charge of the valuation of the land. The valuation of the buildings, to which this article will be confined, was under the direction of the writer. In devising a system for the valuation of buildings it was necessary to originate a plan of action to suit the needs of the situation and the means at hand for accomplishing the results. However, the general plan adopted was similar also to those used elsewhere and was briefly to obtain the cost of reproduction based on unit foot estimates made by competent men in the field with all necessary data before them, and then to apply percentages of depreciation to fit the various cases.

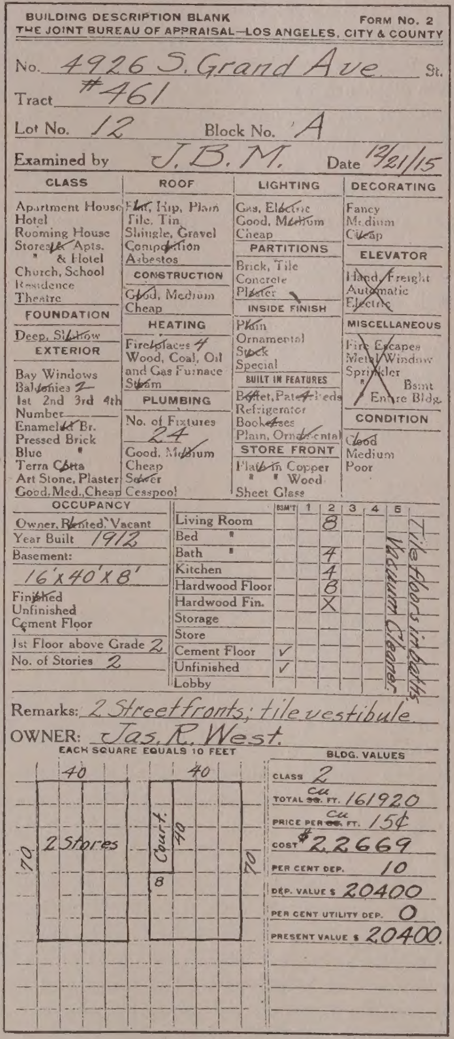
VALUES FOR ASSESSMENT PURPOSES

Before entering upon a discussion of the methods used it will be necessary to outline briefly the special features required of values fixed for assessment purposes. In general it was necessary to allow far less latitude in the matter of personal judgment on the part of the appraiser than is allowed in ordinary appraisal, for two reasons: First, the time available was so short as to preclude the expenditure of more than a very small amount of time in the appraisal of any one building, hence it was necessary to use some method which would permit a very rapid exercise of judgment in the matter of fixing values; second, since the average taxpayer justly wants to know the why and wherefore of values fixed on his property in relation to that of his neighbor, it was necessary to have sufficiently rigid rules for the placing of these values to insure the department against criticisms on the fairness of the methods used. Hence, flexibility was necessarily sacrificed to a certain extent.

BUILDING CLASSIFICATION AND SCHEDULE

The first task was the preparation of a classification covering the various types of buildings to be encountered, and a schedule of unit prices to fit each type. It was necessary that this schedule should be flexible enough to allow a certain amount of exercise of judgment on the part of the man fixing the unit cost, and yet to provide a definite basis for reference in cases of dispute. With this in view the schedule was worked up with the idea of fixing certain standards of value from which prices might be applied to like structures with slight necessary deviations one way or another.

From his own experience, and with the aid of data in his possession, the writer compiled this schedule of costs and verified it by a series of detailed estimates. In every instance the result aimed at was a value for each building which would represent the average of the few low bids which a number of contractors would make on the building under normal conditions, and with prices of labor and material at the average level taken over the last five years. A copy of the classification was sent to a number of the contractors of the community, with a request that they fill in the blank spaces provided for the cost factor according to the dictates of their experience and such data as were in their possession. This classification consisted of brief specifications covering each type of building, and each class, just sufficient for the average builder or architect to be informed of the kind of building intended to be valued. The responses to this request seemed to indicate that generous consideration had been given the answers put down. The results were tabulated and the averages struck.



BUILDING DESCRIPTION BLANK FORM No. 2
THE JOINT BUREAU OF APPRAISAL—LOS ANGELES, CITY & COUNTY

No. 4926 S. Grand Ave. St.
Tract #461
Lot No. 12 Block No. 'A
Examined by J. B. M. Date 12/21/15

CLASS
Apartment House
Hotel
Rooming House
Stores & Apts.
" & Hotel
Church, School
Residence
Theatre

FOUNDATION
Deep, Shallow

EXTERIOR
Bay Windows
Balconies 2
1st 2nd 3rd 4th
Number
Enameled Br.
Pressed Brick
Blue "
Terra Cotta
Art Stone, Plaster
Good, Med., Cheap

ROOF
Flat, Hip, Plain
Tile, Tin
Shingle, Gravel
Composition
Asbestos

CONSTRUCTION
Good, Medium
Cheap

HEATING
Fireplaces 4
Wood, Coal, Oil
and Gas Furnace
Steam

PLUMBING
No. of Fixtures 24
Good, Medium
Cheap
Sewer
Cesspool

LIGHTING
Gas, Electric
Good, Medium
Cheap

PARTITIONS
Brick, Tile
Concrete
Plaster

INSIDE FINISH
Plain
Ornamental
Stock
Special

BUILT IN FEATURES
Buffet, Patent Beds 4
Refrigerator
Bookcases
Plain, Ornamental

STORE FRONT
Plate in Copper
" " Wood
Sheet Glass

DECORATING
Fancy
Medium
Cheap

ELEVATOR
Hand, Freight
Automatic
Electric

MISCELLANEOUS
Fire Escapes
Metal Window
Sprinkler
" Bsmt
Entire Bldg.

CONDITION
Good
Medium
Poor

OCCUPANCY
Owner, Rented, Vacant
Year Built 1912
Basement: 16'x40'x8'
Finished
Unfinished
Cement Floor
1st Floor above Grade 2
No. of Stories 2

	BSM'T	1	2	3	4	5
Living Room			8			
Bed "						
Bath "			4			
Kitchen			4			
Hardwood Floor			8			
Hardwood Fin.			X			
Storage						
Store						
Cement Floor	✓					
Unfinished	✓					
Lobby						

Vacuum Cleaner
Tile floors in baths

Remarks: 2 Street fronts; tile vestibule.
OWNER: Jas. R. West.

EACH SQUARE EQUALS 10 FEET

BLDG. VALUES
CLASS 2
TOTAL ~~SQ.~~ Cu FT. 161920
PRICE PER ~~SQ.~~ Cu FT. 15¢
COST $22669
PER CENT DEP. 10
DEP. VALUE $ 20400
PER CENT UTILITY DEP. 0
PRESENT VALUE $ 20400.

STANDARD FORM FOR FIELD DATA

The value of the results, however, was considered to be not in the averages, as they were more or less distorted, due to the fact that a range of value was asked for for each class. The individual ideas as expressed showed what the extreme range for any one type should be, and the intermediate factors for each class could be interpolated. This check on the original schedule as arranged by the writer proved of immense value in the ultimate working out of the system, as reference was made directly to the contributor, whose values showed an unusual variation, and the ensuing discussion often proved of controlling importance.

APPLICATION OF COST FACTORS

A few of the rules of application of the cost factors should be stated in order to show more clearly the items taken into consideration. Where a cost factor is applied on a square foot basis, the entire floor area exclusive of the basement is included, porches being considered as floor area. Basements, where they occur, are usually very small, and are to be figured at a definite price per cubic foot, depending on the amount of finish and the construction of the walls. The cube of a building embodies that volume between the bottoms of the average footings and the tops of the average fire walls. Neither light wells nor open courts of small area are deducted.

PHYSICAL DEPRECIATION

Having a fair, reasonable basis for the calculation of the cost of reproduction, the next step was the establishment of a method for arriving at a percentage to apply for the natural or physical deterioration occurring in buildings of the various types. It should be made clear that this depreciation includes nothing but the natural decay of material comprising the structure, and contains no element of obsolescence. It is based on the length of life of the building, taking into consideration the various elements of which it is composed, and upon its present state of repair.

TABLE 1—MEAN LIFE OF BUILDINGS—BRICK APARTMENT, CLASS "C"

Material	l Life relative to 75 yr., per cent	c Cost relative to total cost of building	$l \times c$ Cost of items
Foundations	100	11	$1,100
Masonry	100	16	1,600
Steel	100	11	1,100
Lumber	50	20½	1,025
Ornamental iron ...	50	2½	125
Plaster	50	10	500
Partitions	50	2	100
Electric wiring	33	3	100
Painting	10	3	30
Plumbing	33	12	400
Heating	33	4	132
Marble and Tile....	25	5	125
		100	$6,337

$\frac{6337}{100}$ = 63.37 per cent of 75 yr., or a mean life of 47½ yr.

For working out a table for this depreciation various methods were resorted to. The first step was the determination of the average length of life of the different buildings according to the classifications adopted. There are considerable data available on this subject based upon observation and experience in different parts of the country. However, the unusual climatic conditions encountered in Los Angeles, together with the mushroom-like growth of the country, which has introduced a class of buildings adapted to rapid and cheap construction, present problems not met with elsewhere.

LENGTH OF LIFE

From a close study of the buildings of this city and from such local data as were obtainable, a fair idea of the length of life of all types of buildings was reached. This necessitated the actual checking up of buildings of known age and in varying states of repair, and the delving into records of buildings known to have been wrecked on account of their being uninhabitable, and then deriving an average length of life. To check this rather indefinite method a solution suggested by R. P. Bolton in his "Building for Profit" was used. This method involves the use of detailed estimates of a series of buildings of each class as in Table 1.

The lengths of life given the various items in these computations were determined from observations of various cases and from upkeep records of various buildings in this city. The ratio which each part bears to the whole is most readily expressed in terms of its monetary value, as the quantities do not relate to each other in any common terms, except that of money. While the cost is not related directly to the length of life of the building, yet, as the aim is to find the proper falling off of value due to structural deterioration, the assumption is very nearly correct.

This operation was gone through with for a large number of buildings, and a general average taken. The results thus obtained were given the greatest weight in determining the final results, which are given in table 2.

A study of these results showed that for all buildings other than those of frame construction the length of life given corresponds very closely with those used in doing similar work in other cities, and by such authorities as Bernard, Sommers and the Wisconsin Tax Commission.

No building is given complete depreciation, for obviously so long as it is habitable it is of some value from a structural standpoint. Hence 80 per cent was arbitrarily adopted as the maximum depreciation allowed. There are insufficient data on hand to determine the length of life of buildings of the fireproof variety, as none of them are of sufficient age to warrant any deductions. After various estimates had been made by all known methods, the final decision was for a depreciation of 1 per cent per year for all types of fireproof construction.

RAPID DEPRECIATION OF FRAME BUILDINGS

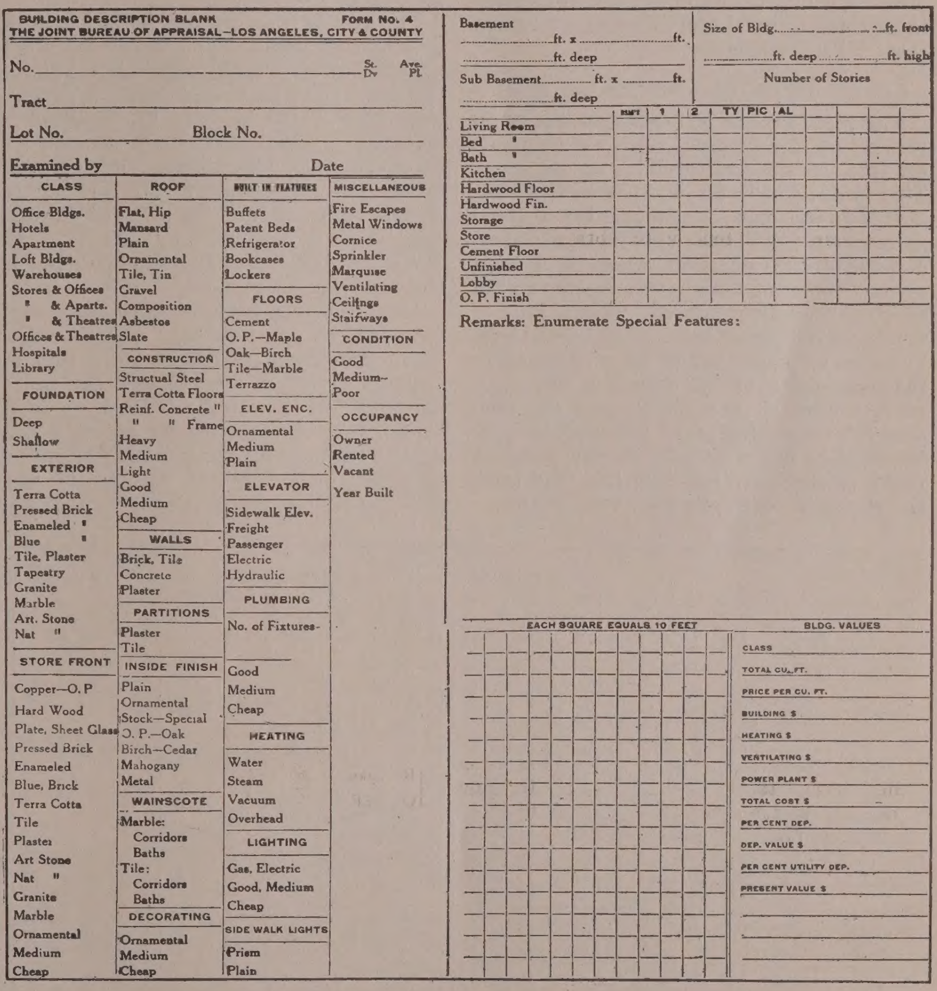
The rapid depreciation allowed for frame buildings is due to the fact that a large proportion of these buildings was constructed and sold direct to the public by investment and building companies. They were built for quick sales and were for the most part of the bungalow type, which has been very popular with the homeseeking people who come to Los Angeles. They are that type of house which presents a fair appearance to the untrained observer, but which is literally "thrown together." Protection from the elements is not a factor of design, and in the majority the joints will open up while they are to all intents and purposes new buildings.

Another deteriorating effect is the result of the extremes of wet and dry weather which prevail in the different seasons. The humidity during at least seven months of the year is very low, and during the remaining months an average of nearly 16 in. of rain falls each season. This has its effect on exposed timber, and, while not so severe as that imposed in other climates, is still a factor carrying some weight when taken in conjunction with lax methods of protecting the structural parts of the wood frame.

LOWER RATE FOR RESIDENCES

The term of life for residences is given as somewhat longer than for bungalows. This is simply because the builders of the two-story class of houses are somewhat more removed from the idea of "shacks"—that is to say, these buildings are usually of better construction; their structural parts are more protected and heavier, and the workmanship and material are of a better and more permanent character.

Observers of this depreciation table will doubtless notice the high percentage of deduction allowed for bungalows and residences for the first year of their life. This was thought necessary on account of the fact that when the "brand newness" of a building used as a home is gone there is a noticeable falling off in the demand for it. This is doubtless the experience of the real-estate men in all parts of the country, but it is especially true in Los Angeles because of the fact that there are always new homes available, and at terms alluring enough to preclude much thought of a second-hand purchase.



BUILDING DESCRIPTION BLANK FORM NO. 4
THE JOINT BUREAU OF APPRAISAL—LOS ANGELES, CITY & COUNTY

No. St. Dr. Ave. Pl.
Tract
Lot No. Block No.
Examined by Date

CLASS
Office Bldgs.
Hotels
Apartment
Loft Bldgs.
Warehouses
Stores & Offices
" & Aparts.
" & Theatres
Offices & Theatres
Hospitals
Library

FOUNDATION
Deep
Shallow

EXTERIOR
Terra Cotta
Pressed Brick
Enameled "
Blue "
Tile, Plaster
Tapestry
Granite
Marble
Art. Stone
Nat "

STORE FRONT
Copper—O. P
Hard Wood
Plate, Sheet Glass
Pressed Brick
Enameled
Blue, Brick
Terra Cotta
Tile
Plaster
Art Stone
Nat "
Granite
Marble
Ornamental
Medium
Cheap

ROOF
Flat, Hip
Mansard
Plain
Ornamental
Tile, Tin
Gravel
Composition
Asbestos
Slate

CONSTRUCTION
Structual Steel
Terra Cotta Floors
Reinf. Concrete "
" " Frame
Heavy
Medium
Light
Good
Medium
Cheap

WALLS
Brick, Tile
Concrete
Plaster

PARTITIONS
Plaster
Tile

INSIDE FINISH
Plain
Ornamental
Stock—Special
O. P.—Oak
Birch—Cedar
Mahogany
Metal

WAINSCOTE
Marble:
Corridors
Baths
Tile:
Corridors
Baths

DECORATING
Ornamental
Medium
Cheap

BUILT IN FEATURES
Buffets
Patent Beds
Refrigerator
Bookcases
Lockers

FLOORS
Cement
O. P.—Maple
Oak—Birch
Tile—Marble
Terrazzo

ELEV. ENC.
Ornamental
Medium
Plain

ELEVATOR
Sidewalk Elev.
Freight
Passenger
Electric
Hydraulic

PLUMBING
No. of Fixtures-
Good
Medium
Cheap

HEATING
Water
Steam
Vacuum
Overhead

LIGHTING
Gas, Electric
Good, Medium
Cheap

SIDE WALK LIGHTS
Prism
Plain

MISCELLANEOUS
Fire Escapes
Metal Windows
Cornice
Sprinkler
Marquise
Ventilating
Ceilings
Stairways

CONDITION
Good
Medium-
Poor

OCCUPANCY
Owner
Rented
Vacant

Year Built

Basement ....ft. x ....ft.
..........ft. deep
Sub Basement..........ft. x ....ft.
..........ft. deep

Size of Bldg..........ft. front
..........ft. deep ....ft. high
Number of Stories

	BMT	1	2	TY	PIC	AL				
Living Room										
Bed "										
Bath "										
Kitchen										
Hardwood Floor										
Hardwood Fin.										
Storage										
Store										
Cement Floor										
Unfinished										
Lobby										
O. P. Finish										

Remarks: Enumerate Special Features:

EACH SQUARE EQUALS 10 FEET

BLDG. VALUES
CLASS
TOTAL CU. FT.
PRICE PER CU. FT.
BUILDING $
HEATING $
VENTILATING $
POWER PLANT $
TOTAL COST $
PER CENT DEP.
DEP. VALUE $
PER CENT UTILITY DEP.
PRESENT VALUE $

HOW THE STRUCTURAL FEATURES WERE CLASSIFIED IN DETAIL

OBSOLESCENCE

The last step in the preparatory work was to devise a method for allowing a depreciation for that subtle, elusive factor of building valuation which has been called obsolescence. At the present time the final decision on this subject is pending, a tentative plan having been submitted to the two assessors which they have under advisement.

This plan which seems by all means the most feasible is as follows: Those sections of the city which have developed a high utility for either retail business, apartments or industrial purposes have been districted according to the degree of obsolescence occurring in the different sections, and the proper percentages marked on the map for each district, for buildings used for residence purposes only. For buildings of other types it has been found impossible to follow any prescribed form of procedure, each case presenting so many different features as to preclude the making of a rule which would fix arbitrarily the amount to deduct.

For the purpose of fixing the percentages to deduct in the different residence districts a close study was made of property sales, and from a comparison of sales made of improved property with those of unimproved it was possible to arrive at amounts which seemed to fit the actual conditions. The cause of the falling off in value of residences in the districts referred to was chiefly two-fold: First, the value of the land had increased, due to the character of surrounding improvements, they being of a kind which served a higher utility, either business, industrial or apartments, thus making the total value of the property such that the rental from a residence thereon failed to pay an adequate income on the investment; second, the presence of this property, of a different utility in many instances, made the surrounding property undesirable from a residence standpoint, it being impossible to sell property in the neighborhood for residence purposes. Thus the only utility for buildings of this kind was for rooming houses, or they were sometimes converted into flats, in a vain effort to preserve their economic value.

The argument has been advanced to the writer that because one of these buildings was earning a higher income than one similar in a different location, the value of the former was appreciated rather than otherwise. It appears that many people often lose sight of the fact that real property embodies the land and all that is permanently affixed thereto. The investment must be considered as a whole and not in part, and if the income fails to meet the expenses of holding, it is a certainty that the property is not properly improved, or that the owner is counting on the speculative element in the land to yield him an adequate return from his investment.

Rapid Shifts in Business Centers

The rapid growth of Los Angeles is again responsible for introducing a variable factor into the general formulas of appraisal. This is due to the rapid shifts in the business centers made necessary by a large increase in population, and the consequent outgrowing of quarters which had been deemed sufficient for a much greater length of time than they actually were. This is particularly true of the business buildings, there being any number of structures in the older parts of the city in a fair state of repair which are not serving the purpose for which they were designed, because the location is not adapted to that purpose. Many of them are standing idle, and some are partially serving a perverted utility.

In dealing with cases of this kind there is only one method of procedure, and that is the exercise of judgment guided by a thorough study of each individual case.

Operation of the System

Before it was possible to begin actual operations it was necessary to devise suitable blanks for the keeping of field notes and for the handling of the large mass of data and computations necessary. The slips illustrated herewith indicate the method used in the collection of the information pertaining to the establishment of records and for applying the cost factors. The field men were divided into two groups: Those who measured and described the buildings and made the necessary sketches, and those who applied the cost factors according to the schedule.

The first of these groups worked in crews of two men each. They were required to approach the occupants of each building and gain from them, and from a personal inspection of the interior, the required information. This was usually done by one man while the other busied himself with taking the measurements and getting the outside information. To this end the first man worked one building ahead of the second, turning over the slip with the inside information complete.

Measurements were taken to the nearest foot, and the measurer used an awl or other sharp instrument which he stuck into the building or the ground to hold the end of his tape. Cloth metallic tapes were found to be the most practicable, as when steel tapes were used breaks were so frequent as to affect materially the amount of work done, as well as being a considerable item of expense. The metallic tapes were lighter and sufficiently accurate for the purpose.

The men who did this work were selected because of past experience in building work. Architects, estimators and contractors being plentiful owing to the depression in this field, a number of excellent men were found.

Pricing

Men who were capable of "pricing" were more difficult to find, and required a large amount of training before they were qualified to do this work. Even after a considerable time spent at this work it was frequently necessary to spend a few hours in the field with them in order to maintain the same standards uniformly throughout. Little difficulty was experienced, however, with buildings requiring a cost factor less than $1.50 per square foot. Above this figure frequent checkings were necessary, and when the price applied was more than $2 per square foot it was a rule to have all such work checked by a second person. It was found advisable to have two men work together through a district which contained a large number of expensive buildings, as the discussion sure to ensue in regard to the proper prices always resulted in greatly increased accuracy of the work done.

It should be interesting to note some of the factors which were always considered in fixing a unit price on any building. The factor which has the greatest influence is what might be termed the amount of concentration of material, or the degree of compactness of the structure. A failure to gage this factor properly means failure in the final result. The general appearance is a matter of relatively small importance, and

Table 2—Physical Depreciation of Buildings in per Cent—Used by Joint Bureau of Appraisal, Los Angeles, Cal.

Age in Years		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	Life in Years
Cal Hs'e	Good...	10	13	16	19	22	25	28	31	34	37	40	43	46	49	52	55	58	61	64	67	70	73	76	78	80																25
	Med....	10	14	18	22	26	30	34	38	42	46	50	54	58	62	65	68	71	74	77	80																					20
	Poor....	10	15	20	25	30	35	40	45	50	55	60	65	70	75	80																										15
Sheds	Good...	4	8	12	15	19	23	26	29	32	35	38	41	44	47	50	53	56	59	62	65	68	71	74	77	80																25
	Med....	4	9	14	19	24	28	32	36	40	44	48	52	56	60	64	67	70	73	76	80																					20
	Poor....	4	10	16	22	28	34	40	45	50	55	60	65	70	75	80																										15
Garage Barns	Good...	4	8	12	16	20	24	28	32	36	40	44	48	52	56	60	64	68	72	76	80																					20
	Med....	4	9	14	19	24	29	33	38	43	48	53	58	62	66	70	74	77	80																							17.5
	Poor....	4	10	16	22	28	34	40	45	50	55	60	65	70	75	80																										15
Bungalow	Good...	10	12	14	16	18	20	22	24	26	28	30	32	34	36	38	40	42	44	46	48	50	52	54	56	58	60	62	64	66	68	70	72½	75	77½	80						35
	Med....	10	13	16	19	22	25	28	31	34	37	40	43	46	48	50	52	54	56	58	60	62	64	66	68	70	72	74	76	78	80											30
	Poor....	10	14	18	22	26	30	34	38	42	45	50	53	56	59	62	64	66	68	70	72	74	76	78	79	80																25
School Church Stores	Good...	4	7	10	13	16	19	22	25	27	30	32	34	36	38	40	42	44	46	48	50	52	54	56	58	60	62	64	66	68	70	72	74	76	78	80						35
	Med....	4	8	12	16	20	23	26	29	32	35	37½	40	42½	45	47½	50	52½	55	57½	60	62	64	66	68	70	72	74	76	78	80											30
	Poor....	4	9	14	19	24	28	31	34	37	40	43	46	49	52	55	58	61	64	67	70	72	74	76	78	80																25
Ap'ts Flat	Good...	6	10	14	18	22	25	28	31	34	37	40	43	46	48	50	52	54	56	58	60	62	64	66	68	70	72	74	76	78	80											30
	Med....	6	11	15	20	24	28	32	35	38	41	44	47	50	53	55	57	59	61	63	65	67	69	71	73	75	77	80														27.5
	Poor....	6	12	17	22	26	30	34	38	42	46	49	52	55	58	60	62	64	66	68	70	72	74	76	78	80																25
Residence	Good...	7	10	13	16	18	20	22	24	26	28	30	32	34	36	38	40	42	44	46	48	50	52	54	56	58	60	62	64	66	68	70	72	73	74	75	76	77	78	79	80	40
	Med....	9	12	15	17½	20	22½	25	27½	30	32½	35	37½	40	42	44	46	48	50	52	54	56	58	60	62	64	66	68	70	72	74	76	77	78	79	80						35
	Poor....	11	15	18	20	22	25	28	31	34	37	40	43	46	48	50	52	54	56	58	60	62	64	66	68	70	72	74	76	78	80											30
Class C Ap'ts Hotels	Good...	6	8	10	12	14	16	18	20	22	24	26	28	30	32	34	36	38	40	42	44	46	47	48	49	50	51	52	53	54	55	56	57	58	59	60	61	62	63	64	65*	55
	Med....	6	9	12	15	18	21	24	26	28	30	32	34	36	38	40	42	44	46	48	50	51	52	53	54	55	56	57	58	59	60	61	62	63	64	65	66	67	68	69	70*	50
	Poor....	6	10	14	18	22	25	28	31	34	36	38	40	42	44	46	48	50	52	54	55	56	57	58	59	60	61	62	63	64	65	66	67	68	69	70	71	72	73	74	75*	45
Hotel Residence	Good...	6	7½	9	10½	12	13½	15	16½	18	19½	21	22½	24	25½	27	28½	30	31½	33	34½	36	37½	39	40½	42	43½	45	46½	48	49½	51	52	53	54	55	56	57	58	59	60*	60
	Med....	6	8	10	12	14	16	18	20	22	24	26	28	30	32	34	36	38	40	42	44	46	47	48	49	50	51	52	53	54	55	56	57	58	59	60	61	62	63	64	65*	55
	Poor....	6	9	12	15	18	21	24	26	28	30	32	34	36	38	40	42	44	46	48	50	51	52	53	54	55	56	57	58	59	60	61	62	63	64	65	66	67	68	69	70*	50
Store Lofts Garage	Good...	2	4	6	8	10	12	14	16	18	20	22	24	26	28	30	32	34	36	38	40	41	42	43	44	45	46	47	48	49	50	51	52	53	54	55	56	57	58	59	60*	60
	Med....	3	5½	8	10½	13	15½	18	20½	23	25	27	29	31	33	35	37	39	41	43	45	46	47	48	49	50	51	52	53	54	55	56	57	58	59	60	61	62	63	64	65*	55
	Poor....	4	7	10	13	16	19	22	25	28	30	32	34	36	38	40	42	44	46	48	50	51	52	53	54	55	56	57	58	59	60	61	62	63	64	65	66	67	68	69	70*	50
Factory	Good...	2	4	6	8	10	12	14	16	18	20	22	24	26	28	30	32	34	36	38	40	42	44	46	48	50	52	54	56	58	60	62	64	66	68	70	71	72	73	74	75*	45
	Med....	2½	5	7½	10	12½	15	17½	20	22½	25	27	29	31	33	35	37	39	41	43	45	47	49	51	53	55	57	59	61	63	65	67	69	71	73	75	76	77	78	79	80	40
	Poor....	3	6	9	12	15	18	21	24	27	30	32	34	36	38	40	42	44	46	48	50	52	54	56	58	60	62	64	66	68	70	72	74	76	78	80						35
Wh'se Church	Good...	2	4	6	8	10	12	14	16	18	20	22	24	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51	52	53*	65
	Med....	2½	5	7½	10	12½	15	17	19	21	23	25	27	29	31	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51	52	53	54	55	56	57	58*	60
	Poor....	3	6	9	12	15	18	20	22	24	26	28	30	32	36	36	38	40	41	42	43	44	45	46	47	48	49	50	51	52	53	54	55	56	57	58	59	60	61	62	63*	55
School Theatre	Good...	2	4	6	8	10	12	14	16	18	20	22	24	26	28	30	32	34	36	38	40	42	44	46	48	50	52	54	56	58	60	61	62	63	64	65	66	67	68	69	70*	50
	Med....	2½	5	7½	10	12½	15	17½	20	22½	25	27	29	31	33	35	37	39	41	43	45	47	49	51	53	55	57	59	61	63	65	66	67	68	69	70	71	72	73	74	75*	45
	Poor....	3	6	9	12	15	18	21	24	27	30	32	34	36	38	40	42	44	46	48	50	54	54	56	58	60	62	64	66	68	70	71	72	73	74	75	76	77	78	79	80	40
Class A Fireproof	Good...	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	19	21	23	25																					90
	Med....																																									82.5
	Poor....																																									75

*Beyond 40 years' percentage of depreciation increases by one per cent per annum for life of building, shown in last column. Maximum depreciation never over 80 per cent.

it was this difficulty that the men who did the pricing had the greatest trouble in overcoming. To aid the pricers the areas of the buildings were computed in the office before being priced, and then with the aid of a pocket slide rule such items as plumbing fixtures, patent built-in beds and other items of the structure could be gaged by computing the amount of floor area per fixture, or per apartment or room.

EFFECT OF STORY HEIGHT

With this same idea of concentration the question of story height belongs. This, in the writer's opinion, has the greatest influence upon cost of any of the items mentioned. An instance of this may be cited in the case of two office buildings known to the writer. They are both built to the limit of height for steel frame buildings in this city; that is, 150 ft. above the sidewalk. One has eleven stories in this height, and the other fourteen. The first is a very expensive building as regards decoration and interior finish, while the second is very plain, and almost cheap in these regards. The first cost 29.5 cents and the second 35.2 cents per cubic foot. There is nothing to which to attribute the 20 per cent advance other than to the small story height of the second building.

In all the pricing the men were required to adhere strictly to the schedule, as in no other way could uniform standards be maintained. Whenever it was thought necessary to deviate from this schedule the matter was referred to the head of the department for consideration. This only applied, of course, when the building was such as to demand a price beyond the extreme limits of all the classes of any one type.

OFFICE COMPUTATIONS

With the cost factors properly applied, the next step was to turn the description slip over to the office force for computation. This process of computation was divided into four steps. First, the areas of the buildings were computed, as before noted, and the percentage of depreciation was set down in its proper place. Also, the basements were computed at a uniform rate per cubic foot, this rate depending on the completeness of the finish, and the kind of walls. In residences the heating plant was also figured separately and set down in the place provided on the slip. Basements and heating plants in frame residences were figured separately, because a very large number of buildings of this type have nothing of the kind in their make-up.

This work was all done by one man, and was then entirely checked by a second, it being found necessary to go over one person's work completely in order to insure accuracy. The remainder of the work was done on a computing machine, operated by skilled girls.

During the course of the computations numerous errors were discovered which had been made by the field men in the collection of the data. These errors were mostly of omissions, but it was necessary to have two men continually in the field for the purpose of correcting these mistakes. The greatest difficulty was encountered in obtaining the exact locations of the various buildings; that is, the legal descriptions of the property upon which they were located.

The filing of these slips completed the process of valuation, and the files were turned over to the assessors for entry on their rolls.

Favors Federal Department of Public Works

C. E. Grunsky in Paper Before Inland Waterways Congress Presents Advantages of Consolidating Engineering Branches of the Government

BELIEVING that if the people of the country understood the problem, it would not be long before some one of the Cabinet positions was replaced by a secretary of public works, C. E. Grunsky, consulting engineer, San Francisco, argued in favor of a federal department of public works before the recent Inland Waterways Congress in San Francisco. He pointed out the lack of interrelation and co-operation between various bureaus and other subdivisions of the Government engaged in engineering work. Co-ordination of these branches would, in his judgment, result in increased efficiency, not alone due to lower costs, but to the better results that would follow from the definite responsibility that would fall upon such a department.

The following extract from his address indicates the branches which he believes should be united under one head, and states briefly the advantages which he expects would result therefrom:

ARMY ENGINEER CORPS

The nearest approach in our scheme of government organization to such a department is the Engineer Corps of the army. The men trained at West Point who qualify as engineers are placed in charge of military defenses and of the nation's river and harbor work. Their record is an enviable one and the magnitude of the enterprises which they direct entitles the Engineer Corps to first consideration when a Department of Public Works is to be organized.

Personally, based on fair experience, some of which was gained in close contact with members of the Cabinet, I am convinced that if the country understood the problem it would not be long before some one of the Cabinet positions were replaced by a secretary of public works.

SCOPE OF DEPARTMENT

In such a department the employment of the engineer staff insofar as permanent positions are concerned should be for life. The accessions to the staff from West Point should be supplemented from the engineering schools of recognized standing. There should be uniformity of rank regardless of the school at which the engineer was trained. But there would naturally be some distinction in the requirement of military service.

It will not be necessary to go further into detail beyond indicating some of the bureaus that would naturally be assigned at once to such a department. There would be the Engineer Corps of the army, and the Reclamation Service, the Isthmian Canal Commission, the Alaska Railway Commission, the Coast and Geodetic Survey, the Water Resources Branch of the Geological Survey, the office of the Supervising Architect, now under the Secretary of the Treasury; the valuation bureau of the Interstate Commerce Commission, and no doubt other bureaus, with later additions of those that are likely to be created to handle swampland reclamation and road work. All of such bureaus naturally belong in a Department of Public Works where their activities would be properly co-ordinated, and where such co-ordination would result in increased efficiency not alone due to lesser cost, but because of the better results that would follow from the general and definite responsibility falling upon such a department.

Rail Failures Ascribed to Poor Quality of Steel

W. C. Cushing Presents Results of Studies Showing That Segregation of Elements Is a Large Factor—Remedies Proposed

THE result of a long series of studies of the causes of rail failures, continued since 1911, were presented by W. C. Cushing, of Pittsburgh, Pa., in a paper of 145 pages, presented before the recent annual convention of the American Railway Engineering Association in Chicago. From his summary the following abstract has been taken to indicate the principal causes of defective heads and of broken rails, and the remedies proposed.

SEGREGATION

Defective heads are nearly always accompanied by a poor quality of metal, and the segregation of the elements carbon and phosphorus is for the most part responsible for the trouble. Brittleness and hardness nearly always follow segregation, and the sulphur is in many cases found to be rather higher than the average.

It would appear that the removal of slag could be accomplished by better care in tapping the furnace stack and pouring from the ladles, plenty of time being allowed for it to come to the surface in each operation.

It should be no more than necessary to call attention to the defective heads with pieces of old tie-plates and other scrap material in them to put a stop to the practice of using that method for protecting the stool of the ingot mold from cutting, yet instances of this have been found in rails rolled since 1909, when such complaints were first made.

As the percentage of phosphorus is nearly always above the limit of 0.10 in cases of split heads, the use of open-hearth steel will control the evil effects of that element.

Control of the segregation of the elements would seem to be possible by the use of the "sink-head" process for making sounder ingots, and more careful teeming, plenty of time being given to allow the chemical reactions to take place. One mill has used this method with good results.

CARE IN ROLLING

The sources of trouble are not ended with the production of a sound ingot. Greater care should be exercised in blooming and rolling, and improved methods should be introduced. Previous studies indicate that large and heavy reduction in the blooming rolls is injurious to the finished product, as it initiates the cracks which result later on in the seams, responsible for many failures, especially in broken bases. The remedy seems to be lighter reduction.

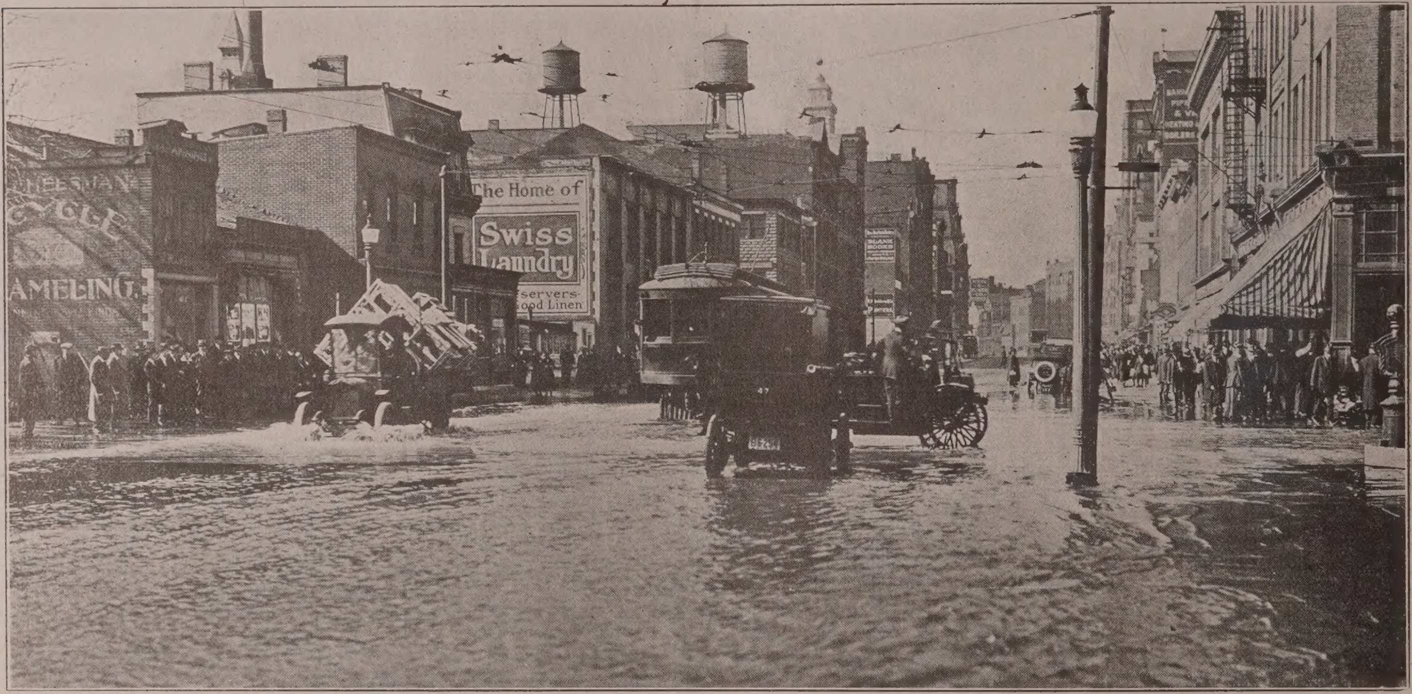
The cases of long-service rails and rails worn out in the tracks seem to show that high carbon is not the only consideration for more durable material, as rails with low carbon have lasted longer under the same conditions than rails with higher carbon though this is by no means always the case. The temperature of rolling is undoubtedly a very strong, if not the strongest, factor in producing homogeneous and durable material.

Record Flood from Melting Snows Passes Through Rochester, N. Y.

Volume of Flow Estimated at 50,000 Second-Feet Exceeding Amount in 1913—Damage Estimated at $300,000

By JAMES P. WELLS
Consulting Engineer, Rochester, N. Y.

SWOLLEN by melted snow to the record volume of 50,000 sec.-ft., the Genesee River swept through Rochester, N. Y., last week, flooding streets and railway yards, undermining pavements and causing property damage estimated at $300,000. It was the worst flood in the city's history, reaching a crest height of 8.52 ft. at the Johnson & Seymour dam in the heart of the city, as against a height of 7.99 ft. recorded during the 1913 flood. Fortunately this year's moderation in temperature on the snow-covered watershed was not accompanied by a heavy rainfall. With a heavy precipitation, combined with the melting snow, the flood volume might easily have attained 100,000-sec.-ft. proportions.



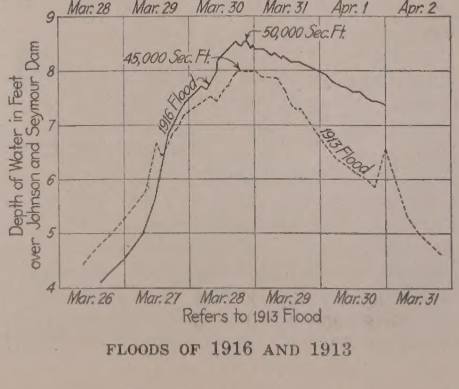
RIVER WATER FLOODED EXCHANGE STREET, IMPEDING MOVEMENT OF VEHICLES AND STREET CARS

GENESEE RIVER DATA

The Genesee River rises in Potter County in the northern part of Pennsylvania, close to the New York state boundary, and flows in a northerly direction across the state of New York. In the northern part of the drainage basin the topography is rough and hilly. For 20 miles above Portage the fall of the river is slight, the slope being only 6.2 ft. per mile. At Portage there is a drop of 330 ft. in 3 miles. From the foot of Portage Falls to Mount Morris, a distance of 17 miles, the river flows through a deep gorge with a total fall of 180 ft. From Mount Morris to Rochester, in a distance of 46 miles, the river winds back and forth through broad flats with a total fall of only 55 ft. At Rochester, within a distance of 2 miles, there are three falls, with a total drop of 231 ft.

In times of flood the water from the upper river and from Canaseraga Creek is discharged upon the broad flats between Mount Morris and Rochester, and a huge lake is created over the entire area. Directly south of Rochester high-water marks have been found 3 miles on one side and 4 miles on the other side of the main river. These flats act as a huge detention basin. The flood waters from the upper courses of the river are temporarily held and the flood at Rochester is prolonged and greatly diminished. In the summer, when the ground water is low on the flats, floods have occurred at Mount Morris greater in intensity than at Rochester.

In 1865 the Genesee valley experienced a very heavy flood which, at Rochester alone, caused a damage of over $1,000,000. Forty-eight years later, during the last few days of March, 1913, a day or two later than the great floods of the Ohio valley, another flood occurred which was greater in volume at Rochester than any since 1865. This was caused by heavy rainfall over the entire upper watershed. Though there was practically no snow on the ground this rain was sufficient to bring about a flood which overflowed into the streets at Rochester and did considerable damage, not only in the city but throughout the entire Genesee valley. The maximum flow during this flood was estimated at 38,000 sec.-ft. at Mount Morris and 45,000 sec.-ft. at Rochester.



FLOODS OF 1916 AND 1913

80 INCHES OF SNOW

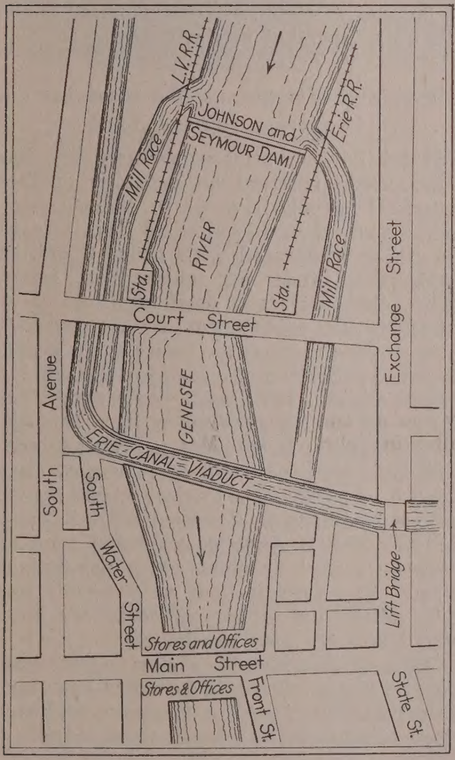
In the latter part of the past month Rochester has again experienced a flood greater, even, than the one of 1913, due not to heavy rains but to melted snow. On March 28, 1913, 7.99 ft. of water passed over the Johnson & Seymour dam in the central part of the city. On March 30, 1916, the peak of the flood was reached when 8.52 ft. passed over the dam. This is equivalent to about 50,000 sec.-ft. This flood was caused by the melting of heavy snows which had fallen in February and March upon ground which was to a large extent, if not entirely, saturated. At Rochester during the month of February there was a snowfall of 36 in. and in March 44 in., making a total of 80 in. for the two months, roughly equivalent to 8 in. of water. This large amount of snow was present over practically the entire watershed. Cold weather continued all through the months of February and March up to within a few days of the flood, giving no opportunity for the snow to melt. The weather suddenly turned warm with a slight rainfall of not over ½ in. The succession of high temperatures during the day and low temperatures at night extended the flood considerably and prevented a much more serious condition.

The greatest menaces to the safety of the business section of Rochester are the aqueduct which carries the Erie Canal across the river and the Main Street bridge. Main Street is the principal thoroughfare of the city and the only business street running east and west across the river. Four-story business blocks are built up on each side of the bridge, resting on piers in the river. The openings between these piers are insufficient to take care of the water, even when unobstructed by driftwood. Large trees often become lodged against

FLOOD CONDITIONS IN SOUTHERN SECTION OF ROCHESTER

HOW SAND-BAG DAMS WERE PLACED TO HOLD WATER BACK

the piers and have to be cut away. During the last flood the arches of the aqueduct were completely filled, as were the openings under the Main Street bridge. The cellars of some of the buildings were considerably damaged. In one instance a stream poured over the floor of a store into the street. After the crest of the flood had passed part of the pavement in Main Street collapsed, and at the present writing no traffic has been allowed through the street. South of the Johnson & Seymour dam the water rose to such a height that it overflowed the Erie Railroad tracks and flowed down Exchange Street to Court Street, where it again entered the river through a millrace. The tracks of the Erie, Pennsylvania and Buffalo, Rochester & Pittsburgh railroads, entering Rochester from the south, were under water and trains could not be brought into the city.



GENESEE RIVER AT CITY CENTER

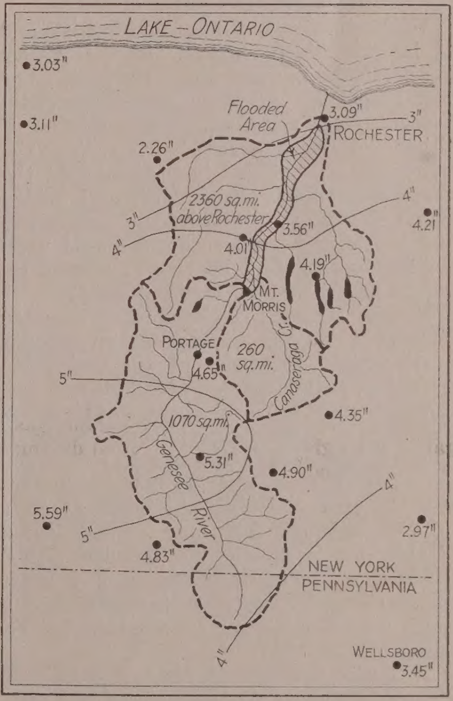
FLOOD RECORDS COMPARED

While the loss of property throughout the valley probably did not exceed $300,000, the flood should serve as a warning as to what might happen if a combination of certain conditions on the watershed should occur. As has been stated above, the present flood was due only to the melting of snow. It resulted in a flood of 50,000 sec.-ft. In March, 1913, approximately 5 in. of rainfall on the upper watershed, with little if any snow on the ground, produced a flood of 38,000 sec.-ft. at Mount Morris and 45,000 sec.-ft. at Rochester. If such a rainfall, which is not at all improbable, should occur on the Genesee watershed when the ground was covered with such a depth of snow as in the present year, it is very likely that there would be a flood of at least 80,000 sec.-ft. at Mount Morris, with a correspondingly greater flow from the other tributaries. Under such conditions, with the river flats already saturated, the flood at Rochester would undoubtedly amount to from 80,000 to 100,000 sec.-ft.

The storm which produced the heavy rainfall in the Genesee valley in 1913 was the same storm which produced rainfalls of over 10 in. in some parts of the Ohio valley. Preceding the flood of 1913, the average rainfall on the watersheds of the Scioto and Olentagny Rivers, which unite at Columbus, Ohio, was 9.14 in. This produced a flood estimated at 80,000 sec.-ft. On the Scioto, a stream with a drainage area of 1050 sq. miles, and a flood of 60,000 sec.-ft. on the Olentagny, a stream with a drainage area of 520 sq. miles, or a combined flood of 140,000 sec.-ft. from the 1570 sq. miles comprising both watersheds. The drainage area of the Genesee is 1070 sq. miles at Mount Morris. and Canaseraga Creek, which enters the river directly below Mount Morris, has a drainage area of 260 sq. miles. The combined area is 1330 sq. miles, or 84 per cent of the combined drainage area of the Scioto and Olentagny, which produced a flood of 140,000 sec.-ft.

Such a rainfall as occurred in 1913 in the Ohio valley has not occurred in the Genesee valley since records have been kept, but there is nothing to indicate that such a rainfall might not occur at any time. In 1889 the rainfall was extremely heavy over an area of 20,000 sq. miles in Pennsylvania, in some places exceeding 10 in. At Wellsboro, a short distance to the southwest of the Genesee basin, 9.8 in. fell, of which 7.5 in. fell in less than 10 hr. A similar storm, covering a large area, occurred in New England in 1869. That such a heavy rainfall has not occurred on the Genesee watershed for several decades appears to be due only to chance. In the event of such a rainfall on saturated or frozen ground there is no doubt that the flood at Mount Morris would equal at least 80,000 sec.-ft., and at Rochester from 80,000 to 100,000 sec.-ft. With a rainfall of 9 in. and an appreciable amount of snow on the ground a flood much greater than the above would result. In view of these facts it is evident that the city of Rochester would not be going beyond the limits of conservatism by preparing for a flood of a least 100,000 sec.-ft.

At the present time the city has under construction the deepening of the river channel through the city. It is estimated that upon the completion of the river deepening plans the channel will take care of from 60,000 to 70,000 sec.-ft. This is not sufficient. With a flood of 100,000 sec.-ft. at least 30,000 sec.-ft., in itself a good-sized flood, would have to find its way back to the river through the streets in the heart of the business section. There would undoubtedly be a repetition of the conditions in Dayton and Columbus in 1913.



GENESEE WATERSHED AND RAINFALL RECORDS FOR MARCH 23-27, 1913

Drainage area at Rochester, 2360 sq. miles; at Mt. Morris, 1070 sq. miles.

Removal of some of the obstacles to the natural flow of the river in the Rochester business section and the construction of retaining walls would greatly help matters, but not to a sufficient extent. Reservoir control of the waters of the upper river appears to be a solution which would give the greatest benefit, not only to Rochester but to the entire valley between Mount Morris and Rochester. For several years the construction of a large storage reservoir at Portage has been advocated by engineers and commissions. Extensive surveys and plans were made by the New York State Water Supply Commission. It was planned to construct a masonry dam 152 ft. high, which would set the water back 15 miles, creating a reservoir with a total capacity of 19,000,000,000 cu. ft., part of which was to be available for power purposes.

There is not sufficient space to discuss here the various reasons why this has not been done. The chief difficulties appear to be legal. The cost was estimated at less than $5,000,000 without any power plant, and this sum included the relocation of 17 miles of the Pennsylvania Railroad and the purchase of all the necessary property. The construction of this reservoir, if a sufficient amount of its capacity were reserved for flood protection purposes, would greatly reduce the danger of destructive floods in the Genesee valley and at least partly, if not entirely, remove the danger with which Rochester is at all times menaced. It is to be hoped that steps will be taken leading to some adequate solution before the disasters of 1913 in the Ohio valley are repeated on the Genesee.

Inverted Siphons Replace Bridges Where Canals Meet Roads

THE extensive system of main canals and laterals which traverse Imperial Valley has presented in many places the problem of how to get the highway across the canal without interfering with the function of either. Bridges were built across the larger canals, but due to the fact that the channels are above ground level, each bridge required a heavy grade on the approaches and the larger canals often imposed upon the highways grades heavier than were required anywhere else in the district.

It was formerly believed that inverted siphons would not be feasible on account of the great quantities of silt which the irrigation water carries and which it was thought would soon fill up an underground conduit. A few experiments, however, showed that for velocities of 2 ft. per second or more, inverted siphons made of corrugated pipe would keep the conduits clear of silt, although 3 ft. per second is desirable for carrying the heavier sands. Since these facts were developed a great many siphons have been installed, and a much more satisfactory road system has resulted.

A large number of the recently constructed siphons are of corrugated iron pipe, the collars and head walls being of concrete. In the northern part of the county, as in the Imperial Water Company No. 3, the head walls and the barrels themselves are often made of concrete because gravel can be easily secured in this vicinity. Actual demonstration has proved, it is claimed, that concrete barrels can be constructed more economically than corrugated iron pipe can be purchased. In the southern part and more thickly settled district, it is true that a great number of timber siphons have been constructed owing to the lack of materials for concrete construction, but by far the greatest number are of corrugated iron pipe with either concrete or timber head walls.

The inverted siphon scheme of crossing also obviates the difficulty formerly experienced where it was necessary to carry two canals across a road and across each other near the same point, particularly where it was necessary to provide for heavy traction engines. This problem is now solved by the use of two inverted siphons, one beneath the other, crossing at right angles, and each intersecting the road at 45 deg.

Due to the scarcity of good gravel in the valley and the resultant high price of concrete structures, it is customary to build inlet and outlet wells for inverted siphons of Oregon pine. It has been found that these wooden wells last about eight years in the dry soil of this district and this length of life is considered as suitable as more permanent work, due to the likelihood of some change in location or design being required at the end of that time.

Imperial Valley has for many years been supplied with water by the California Development Company, for which company J. C. Allison was chief engineer at the time of its recent sale.

Experts Report on Meters for Chicago

Committee of Engineers Recommends the Metering of Public and Big Business Buildings Now and Eventually All Consumers

THE city of Chicago is now using 254 gal. of water per capita per day. A large part of this amount is due to wasteful usage or to leakage, and engineers agree that the only relief from this is through metering. A special engineering sub-committee on water waste of the City Club of Chicago has recommended that the following preliminary steps should be undertaken in 1916:

PROCEDURE

(a) The City Council should appropriate $10,000 for the construction of meter vaults at the curb where meters cannot be set in basements. Such vaults, readily entered by meter readers and set and owned by the water department, have been found necessary in Cleveland and many other cities. The department is prepared to set over 2000 meters on large business places as soon as the City Council appropriates the necessary funds.

(b) All unmetered premises devoted in whole or in part to business uses and all public buildings should be metered.

(c) The city water department should have the authority to set meters, not only, as now, where the frontage rate is $100 per year and more, but where it is $50 a year. Later the limit should be reduced to $25.

The popular opposition to meters, according to the report, is so great in cities where metering has not been tried that it is of vital importance to take lessons from the experience elsewhere. Meters can be made so popular, as in Cleveland and Milwaukee, that city councils and the public will be unanimously in favor of them; or the subject may be so botched, as in the past in Philadelphia, that public sentiment will be equally strong against them.

CONDITIONS FOR SUCCESS

For success four conditions must be fulfilled:

1. Minimum rates must be established whereby everyone now paying water bills will be obliged to pay for a certain amount of water, whether used or not. The consumer would then pay at the regular metered rate for all water used in excess of that amount.

2. Meters must be furnished, set and maintained at the expense of the water department and through department employees.

3. Meters must be furnished not only to such districts and individuals as are known or suspected of wasting water, but should be furnished indiscriminately, so that the meter will not come as a penalty for carelessness or wastefulness, but, to those who are careful, as a sane method of reducing water bills.

4. The city administration undertaking the task must look upon the meter not at all as the means in the aggregate of increasing revenues to the department, but rather as a means of decreasing future investments in extension of mains, pumping stations, etc., and of improving the pressure. Meters will more than pay for themselves in these ways, while if they are accompanied with such rates as will increase the revenues or even keep the growth of revenues quite up to the present rate, they are sure to bring such a burden for a while to the less prudent of the community as to make the whole idea obnoxious to the people.

COMMITTEE PERSONNEL

The personnel of the committee making the recommendations is E. W. Bemis, public utility engineer; Ray Palmer, former commissioner of electricity and gas, and H. W. Clausen, assistant city engineer.

Resurface Bituminous Macadam for 8.6 Cents per Square Yard

THE Lowden road at Oregon, Ill., has recently received an asphaltic surface coat. Originally it was a bituminous macadam road of soft local stone from 3 to 10 in. thick penetrated with about 2 gal. of Aztec road binder per square yard. Later, when the soft stone used began to show through the asphalt surface in places it was decided to treat the entire surface with a light application of a high-grade asphaltic material and a very hard, coarse sand. The following cost figures taken from the *Illinois Highway Bulletin* do not include contractor's profit or overhead expenses. In a length of 16,222 ft. a total of 30,906 sq. yd. of road surface was treated with 1/3 gal. of Trinidad B asphalt and 0.016 tons of torpedo gravel or stone chips per square yard. The average haul of materials was 1½ miles. Labor was 25 cents per hour and teams 50 cents per hour.

In the following table giving the itemized cost of the work it will be noted that certain items were paid by the state highway department from the maintenance fund.

ITEMIZED COST OF WORK

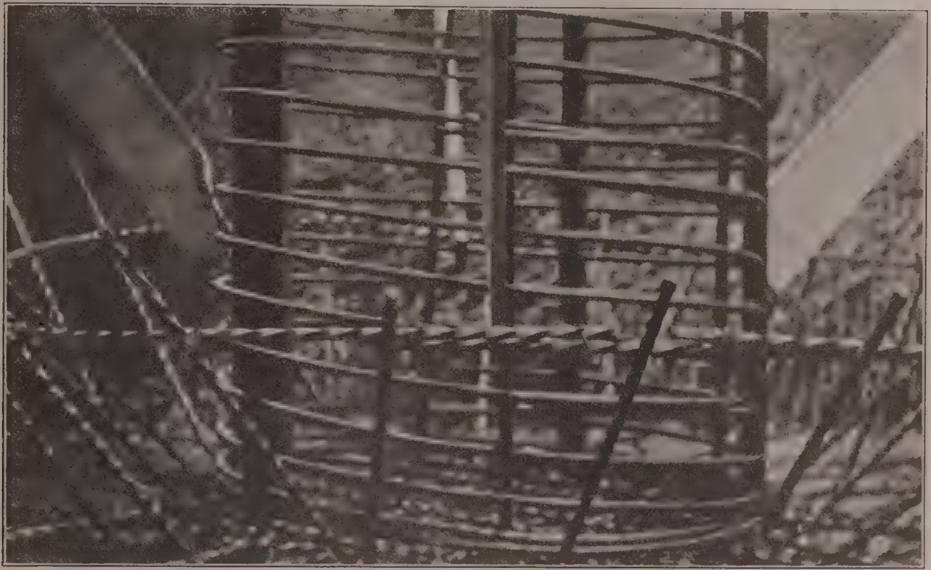
	Cost in Cents per Sq. Yd.
Engineering and inspection	0.00*
Superintendence	0.35
Bituminous material, 9617 gal. at 7.7 cents f.o.b. siding	2.39*
Torpedo gravel and stone chips, 484 tons: stone $1.40; gravel $1.82½ f.o.b. siding.	0.12* 2.55
Hauling torpedo gravel and stone chips	0.84
Heating and applying bituminous material, demurrage, etc.	1.04
Spreading torpedo gravel and stone chips	0.56*
Sweeping and cleaning old road	0.05
New equipment (pump)	0.07*
Freight on equipment	0.15
Incidental expense	0.22
Culverts and patching holes	0.27
Total cost	8.61

*Indicates paid by the state highway department from maintenance fund.

Spiral Steel Placed in Power House Foundations

Solid Steel Slab Column Bases Reduced in Size by Hooping the Reinforced-Concrete Footings to Increase Allowed Stress

IN ORDER to keep within commercial sizes for the dimensions of the solid steel slab bases of the columns in the new Philadelphia Electric Company Power House, described in the Engineering Record of Feb. 19, page 340, it was necessary to increase the allowable bearing pressure on the reinforced-concrete footings. The Philadelphia building code at the time of the design limited the direct pressure on reinforced concrete to 500 lb. per square inch. By hooping the concrete immediately below the columns, however, the allowable pressure was raised to 1,000 lb. per square inch, although only 800 lb. per square inch was used.

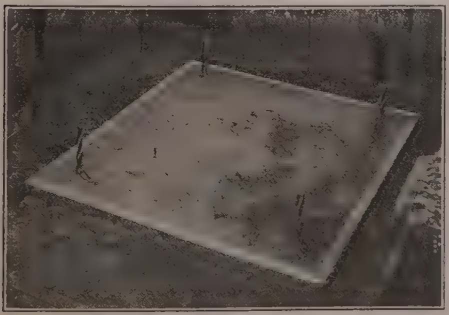


TYPICAL HOOPED PIER REINFORCEMENT

The accompanying photograph shows the appearance of the hoop reinforcement for a typical column carrying a load of 900,000 lb. The reduced size of the steel slab here used was 34 x 34 x 5¼ in. and the maximum size used on a hooped footing was 38 x 38 x 5¾ in. All hooping was 48 in. in diameter, with ¾-in. round steel in spirals on 4-in. centers.

CONCRETE BASES OR SCREEDS

As it was essential that the bearing under the steel slabs should be as perfect as possible, and to avoid air pockets which might be caused by grouting after the slabs were wedged and leveled in position, it was decided to do away with grouting altogether by forming cement bases on top of the reinforced concrete, and allowing the steel slabs to rest directly on these cement bases or screeds. It was found possible to work these screeds to a remarkable degree of accuracy. The allowable variation from a perfectly level surface under the slab was only 1/64 in. This method gave practically perfect bearing for the slabs and allowed inspection of the screed before the steel slabs were placed. The accompanying photograph shows a finished screed, with the remains of some loose hay used to protect it from the frost.



SCREEDS ACCURATELY LEVELED

Vertical rods encased in the hooping were extended up to the outside of the steel slabs, and horizontal reinforcing rods were used around the screeds. The screeds and steel slabs were all encased in stone concrete.

Test Douglas Fir Stringers

New Method of Creosoting Removes 35 Per Cent of Total Moisture and Reduces Strength of Wood Only 16 Per Cent

THE average strength of representative Douglas Fir stringers, subjected to a process of creosoting involving boiling under vacuum and resulting in the removal of 35 per cent of the total moisture in the specimen, has been shown to be approximately five-sixths of the original strength, compared to a one-third decrease with other processes. The conclusion also has been drawn that the decrease in strength is not confined to the area of the stringer penetrated but that the whole structure is weakened. The decrease in the compressive strength of treated specimens when the load is applied parallel to the grain has been found to be only 6 per cent, while compressive tests perpendicular to the grain showed a decrease of 26 per cent. The tests, arranged by the St. Helens Creosoting Company, St. Helens, Ore., were conducted under the supervision of Atchison, Topeka & Santa Fe Railway engineers and officials, O. P. M. Goss, consulting engineer for the Pacific Coast creosoting and timber interests, and other interested parties. The results were reported by H. B. MacFarland, engineer of tests for the Santa Fe, to the recent convention of the American Railway Engineering Association.

A test lot of 356 stringers was procured, out of which 61 representative specimens were selected. Nine of these were put to special tests after being treated, while 52 stringers were cut in two and comparative tests made of the untreated and treated halves of each specimen.

RESULTS COMPARED

A comparison of the results of the transverse tests, applying loads at the third points, of 7 x 16 in. by 14 ft. span treated and untreated stringers shows that of the 52 representative untreated specimens, 16 failed by shear, 29 by tension, 3 by tension and shear, 2 by crushing and tension, one by crushing and shear and one by crushing, while the following numbers of treated stringers failed from the causes noted: 32 shear, 14 tension, 4 tension and shear, and 2 crushing and shear. The number of treated specimens failing due to shear is just double that of the untreated ones. The average elastic limit of the untreated pieces was 4269 lb. per square inch as compared to 3481 lb. per square inch for the treated stringers. The average modulus of rupture was 5691 lb. per square inch for the untreated and 4680 lb. per square inch for the treated stringers. The average longitudinal shear for the untreated pieces was 411 lb. per square inch, which was 78 lb. per square inch greater than that for the treated specimen.

COMPRESSION TESTS

Specimens for the compression tests, applying the load parallel to the grain, were 5 x 5 x 12 in. in size. It was found that the maximum load for the untreated pieces was 4114 lb. per square inch and 3869 lb. per square inch for the treated blocks.

Applying the load perpendicular to the grain of 6 x 6 x 30 in. blocks showed that the treated specimens had an average elastic limit of 322 lb. per square inch, which was 116 lb. per square inch less than the average for those that were not treated.

The average area penetrated by creosote as determined by this test was 20.41 per cent.

The conclusions, as presented in the report, are:

1. Moisture may be successfully removed by boiling under vacuum. Moisture determinations show that, on an average, 35 per cent of the total moisture was removed by the process.
2. The removal of moisture by boiling under vacuum, preliminary to creosoting, decreases the physical strength of the material.
3. The weight of creosote per unit of volume for treated material is dependent on the structure of the specimen. Springwood offers greater resistance to treatment than summerwood.
4. Special tests of treated stringers indicate that the decrease in physical strength due to treatment is not confined to the area penetrated by creosote. The entire structure is affected.
5. The compressive strength parallel to the grain was decreased 6 per cent.
6. The compressive strength perpendicular to the grain was decreased 26 per cent.
7. Although the average strength of the treated material is appreciably decreased, its stiffness, as measured by the modulus of elasticity, is not affected.
8. In general, the average strength of Douglas Fir bridge stringers, subjected to the boiling-under-vacuum process of creosoting, was five-sixths of its original strength.

National Defense—For Engineer and Contractor

Sixth Article in Series Describing Methods of Military Map Making and Topographical Surveying for Tactical Uses

By MAJOR P. S. BOND
Corps of Engineers, U. S. Army

IN these times, when the combatant forces are numbered by millions, when the theater of war may embrace an entire continent, and when troops may be transported hundreds of miles in a single day, the need of complete and accurate maps and information is far greater than in the past, when military operations were more restricted as to numbers and area. It will be evident that the commander cannot view the field of conflict nor the progress of events except as portrayed on a map. The modern game of war, then, is played upon a map. On a table in his tent or office the strategist records and watches the ever-changing situation and plans the movements of troops many miles away.

The simplest scouting expedition or reconnaissance requires a map for its rapid and successful prosecution, and its report, to be intelligent, must be accompanied by a map or sketch. Each outpost, each camp, each march is recorded and reported on a map. Each section of a line of defense must be mapped. The enemy's dispositions, movements and works are reported by means of maps and sketches. It is, therefore, absolutely essential that all officers from the highest to the lowest should be able to read a map and also to make one.

HOW MAPS ARE MADE

The duty of mapping will fall especially upon the engineers. It is incumbent upon them to collect, amplify and bring up to date all existing maps and to arrange for their reproduction and distribution. The engineer officer must be able to make a map on foot, from an automobile, an aeroplane, or on the back of a horse. He must be able to sit on a hill and map the country in front of him, estimating the distances and sensing the topographical features which he cannot see.

Accurate maps require much time and skill for their preparation. If they are not available in advance of hostilities the army must prepare its own maps of the theater of operations under war conditions. This will delay and hamper their operations, both because time will be required to prepare the maps, and because maps produced under such conditions must necessarily be rather crude and inaccurate. Accordingly, the preparation or collection, in time of peace, of accurate maps, suitable for military use, of all possible theaters of war is an essential part of any scheme of national defense. Commanders have frequently been compelled to conduct campaigns without good maps prepared in advance, but it is certain that they were thus greatly handicapped.

There is much of our own country which has not as yet been accurately surveyed, and of Mexico, Central and South America and the Orient we possess no satisfactory maps. The best available maps for military purposes are those of the U. S. Geological Survey. In time, this survey will cover the entire country and will form an important item of our scheme of preparedness, but at present much remains to be done.

MAP SCALES FOR ARMY WORK

The scale of the maps is a matter of great importance, and for military uses maps on various scales will be required. For strategical operations over a considerable area small scale maps will be needed. These, of course, cannot exhibit topography in detail, but only the more important strategical features, such as rivers, mountains, main highways and railroads, important cities, fortifications, etc. Useful scales for strategical purposes vary from about ½ in. to the mile to 10 miles to 50 miles to the inch. If such maps are not available in suitable form at the outbreak of hostilities they must be prepared by a compilation of miscellaneous and often discordant data. Errors in the important distances may be, to some extent, eliminated by astronomical observations in the field. For tactical purposes maps must be on a scale sufficiently large to portray topographical details, yet not too large for convenient use in the field. Experience indicates that a scale of 1 in. to the mile fulfills these requirements. The U. S. Geological Survey maps are on a scale of 1:62,500, which is approximately 1 in. to the mile (12 x 5280=63,360). The map executed by the military sketcher in the field for use in conjunction with the 1-in. maps will vary from 1 to 3 in. to the mile for road sketches, and from 3 to 6 in. to the mile for position or area sketches.

It is certain that in any military operations in which the United States may engage, extensive surveying and mapping, both on a small and on a large scale, will be required subsequent to the outbreak of hostilities. When the surveys can be executed under cover of the first-line troops the methods for mapping will be based upon those employed in time of peace, except that refinements and hair-splitting accuracy will be relegated to the background and speed will become paramount—as in all military engineering. The control will be established by astronomy, triangulation, traverse and extensive leveling. The filling in will be done chiefly by the methods of individual military sketching. On such surveys many of the great number of civilian surveyors in the United States may be usefully employed, if under the direction of engineer officers who appreciate military requirements and understand military methods.

In survey work executed with the fighting forces at the front quick results will invariably be demanded, and must generally be obtained with such simple instruments as can be conveniently carried on the person of the topographer, or with no instruments at all. These conditions have resulted in the adoption of instruments and methods which are characteristically military. While a number of methods are employed, that most commonly used is a crude and hasty adaptation of the plane table method of surveying, in which the skill and experience of the topographer must compensate for the lack of accurate instruments.

THE MODERN GAME OF WAR IS PLAYED UPON A MAP—THE STRATEGIST RECORDS AND WATCHES THE EVER-CHANGING SITUATION AND PLANS THE MOVEMENT OF TROOPS MANY MILES AWAY.

The military plane table consists of a small board, 12 x 12 in. in size or less, which is held against the body of the sketcher or mounted on a light portable tripod. The board is leveled by eye or by a small spirit level placed on the board or attached to one of its edges. It is oriented by means of a compass, which may be in a separate case, or may consist merely of a declinator attached to the edge of the board. The alidade is a small, flat ruler with folding sights, or more commonly a simple, three-cornered piece of wood, the sights being taken along its upper edge. The horizontal position of points is determined by intersection and resection by laying off the directions and measuring the distances, etc. Distances are measured by pacing and counting with a "tally," by a speedometer, or an odometer on the wheel of a vehicle, by the "walks" of a horse, or by time at a known gait, either afoot, in a vehicle, or on horseback. In some cases, especially in "place sketching," where the sketcher cannot occupy the ground he is to map, distance may be determined by some form of simple range finder, or by angles measured with a pocket sextant or compass from the

THE MILITARY METHOD OF MAP MAKING IS A CRUDE ADAPTATION OF THE PLANE TABLE METHOD OF SURVEYING—THE SKETCHING BOARD IS ORIENTED BY COMPASS AND A RULER SERVES AS AN ALIDADE.

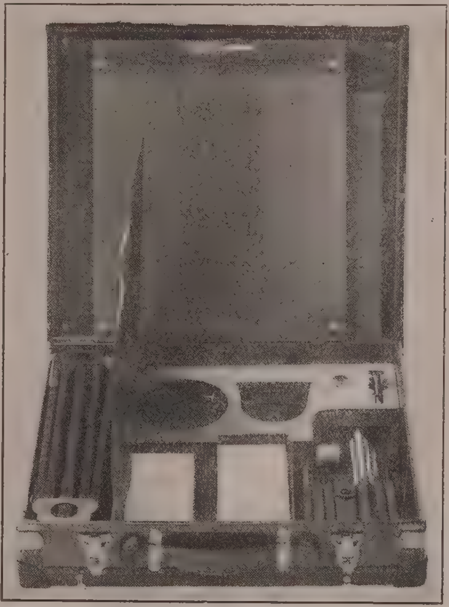
ends of a known base (intersection). The sketcher will construct the necessary scales of paces, wheel revolutions or time. If the length of his own stride or the gait of his horse has not been determined, this will be done by several pacings of a known distance. The scales are laid out on paper and pasted to the edges of the alidade. Horizontal angles are laid off by compass sights or in some cases measured with a pocket sextant and laid off with a protractor.

Slopes Quickly Determined

Absolute elevations are determined with a small pocket aneroid. Slopes are measured by sighting along an edge of the sketching board, held in a vertical plane, and reading the slope by means of a plumb line and graduations on the lower edge of the board. They may also be measured by a simple hand clinometer, such as the Abney, with which very close results are obtained by a skilled operator. The sketcher will be provided with a set of scales of "map distances." A "map distance" is the horizontal map interval between contours. It varies with the scale of the map, the vertical interval between contours, and the slope of the ground. As the first two are fixed the map distance varies with the slope, and the scales indicate the map distances or horizontal intervals between contours for various slopes. Having measured a slope, the number and position of the contour points is determined by applying the map distance scale for that slope, no computation being necessary. If the slope is not uniform the contour points are adjusted by eye, but their number is fixed by the scale. Elevations thus determined may be checked with hand level (or the clinometer set for zero slope) and aneroid barometer.

Select Critical Points

The method of procedure in making such maps is to determine as accurately as practicable by the methods above described the true horizontal position and elevation of a number of critical points in the terrain, and then, using these as a skeleton or control, to fill in the intervening topography by eye. The speed with which such a map can be made and its accuracy when completed will depend very largely on the skill of the sketcher in selecting and locating the critical and prominent points of the terrain which will be of use to him in selecting stations affording good views of as large an area as possible, and in estimating intermediate distances and slopes and interpreting ground forms. The valley or stream lines and the hills and ridges form the natural skeleton for a topographical sketch. If the position of the stream lines and two or more elevations on them be determined, together with the position and height of the adjacent knolls and ridges, the topography is readily sketched in by eye. If the sketcher has skillfully selected and determined the controlling elevations and distances the chance of cumulative errors is greatly reduced and the sketched-in topography may compare favorably in accuracy with a painstaking instrumental survey. Skill in such work is attained only by practice. The greater the skill the smaller the number of controlling points that will be required. If the sketcher is a proved adept at estimating distances he can dispense with many of the careful measurements which the novice would be forced to make.



MILITARY SKETCHING BOARD OUTFITS PACKED IN CARRYING CASE

Desirable Detail

Care should be taken to avoid cluttering the map with details, but it must, nevertheless, exhibit all features that are of military importance. The conventional signs employed are few and simple. Extensive wooded or cultivated areas are designated by tracing their outline and noting the nature of the growth—"shocked corn," "standing wheat," "open wood,'" etc. Notes should describe the nature of roads—"good macadam, 16 ft.," "good earth, 12-ft., ditches," etc. The span, width of deck, height, material and practicable load of bridges is indicated by notes. Buildings are never drawn to scale, but the size and construction of important buildings may be indicated by a note. Fords are designated by noting width, depth and velocity of stream, nature of approaches and bottom. The names of railroads, gage, number of tracks, location and capacity of stations, sidings, water tanks, the rolling stock available, etc., are noted, as also the names and distances of adjacent stations in both directions, the vulnerable points of the road, such as large bridges, tunnels, etc. Telegraph and telephone lines are of special importance; the adjacent towns to which they lead should be ascertained by inquiry. Streams which may be used for water supply should be roughly gaged. Ground suitable for camp sites or defensive positions should be noted. The local resources in the way of crops, animals, foodstuffs, tools, machinery, etc., should be ascertained approximately. Towns are described by giving their populations, nature of industries, stock and output of mills and factories, important buildings, railroads, telegraph and telephone communications, etc. There is hardly a local feature which may not be of importance from a military point of view. The reconnaissance will generally be for the purpose of investigating certain particular conditions, but

SOMETIMES THE TRANSIT IS EMPLOYED FOR ACCURATE MILITARY SURVEY WORK even under such instructions very important matters outside of the instructions should be reported. The officer charged with such duty must have his powers of observation and acquisitiveness developed to a high degree.

Map 10 Miles a Day

By the methods herein outlined a competent sketcher may map 10 or more miles of road per day, sketching in also the topography on each side which is visible from the road. In sketching an area he may cover from ½ to 2 sq. miles in a day, depending upon his skill and the nature of the terrain. Where an extensive area is to be surveyed the work is divided into a number of small areas, with natural or artificial lines of division, which are mapped simultaneously. A number of these areas will be in charge of a principal sketcher whose duty is to distribute his subordinates, fixing the limits assigned to each. He makes certain that each individual sketcher connects with his neighbor on either flank by having one or more points in common, without overlapping or duplicating work further than is necessary to join the two sketches in one. He carries an aneroid barometer with which he gives each sketcher the elevation of his starting point. He may be accompanied by an assistant who measures the distances and sketches the important features along the base line from which the area sketchers start. This is used later to combine and co-ordinate the individual sketches. These are turned in simultaneously and are pieced together and retraced or otherwise prepared for reproduction. As the sketches are usually made on translucent vellum, they may be printed directly.

Mapping operations on a large scale will ordinarily involve the correction, amplification, compilation and reproduction of maps, and this duty will fall to the Engineer Department. So far as possible it should be done in the office, away from the haste and confusion of the field, but much of this work must necessarily be done in the field, especially reproduction. Actinic printing processes are often too slow for satisfactory reproduction in the field. The best field method now generally employed is lithography, or rather zincography, since the excessive weight of litho stones renders them inconvenient for rapid transportation. The engineer troops are accordingly supplied with an efficient and portable outfit for map compilation and reproduction, including drafting, photographic, actinic printing and lithographic (zinc) apparatus. This is one of the most important items of their equipment.

Map-Reading Vital

While not every officer and non-commissioned officer will be called upon to make maps and sketches, all, from the highest to the lowest, will frequently have to read and interpret them. An officer who is not an adept in map reading will be at a great disadvantage in the exercise of independent command. The map should convey to his mind a fairly accurate picture of the actual ground, and he should be able to rapidly and accurately obtain any information which the map can furnish. Such facility is acquired only by long practice. To locate one's position on a map, to orient it, to determine the difference of elevation or the distance between two points are apparently simple matters, but if it is a question of moving troops there are many other considerations. What are the widths, character and condition of the roads? What grades will be encountered? At what average speed can a wagon train move? Is the road open or shady? Can it be easily observed from adjacent heights, or possibly fired upon? What towns lie upon it? Is there a telegraph line alongside? Are there bridges over the streams? If so, are they in good condition and amply strong to carry the loads accompanying the army? If not, how long will it take the engineers to fix them? Are there fords nearby? What are the depths of water? What effect do floods have? Is a certain locality suitable as a camp site for a certain body of troops? How about the water supply? Is there shade? Is the drainage satisfactory? Is fuel available? How should the various organizations be disposed? Is the locality defensible? Where should the outpost line be placed and how many men will be required to cover it? If a defensive position is to be taken to cover some important point or some movement of troops, where is the best general line for occupation? Can the enemy avoid it or must he attack? Is there natural cover available? How about the roads and other communications? Are there good observing stations and sites for the artillery? Is the field of fire satisfactory? What natural obstacles exist? How about the facilities for retreat or withdrawal? Are the flanks secure? What materials for construction will probably be available? Can civilian labor be secured—if so, to what extent? These and many similar questions must be tentatively answered from maps, sketches and reports of reconnoitering parties, but it is to be remarked that the final dispositions will almost invariably be made upon the ground itself, for the best map cannot answer all questions that arise.

One interesting problem that is often encountered in military operations is that of visibility, a question as to whether a certain point or area is visible from a certain other point. Such a problem can seldom be solved with great precision on a map, but an approximate solution will often be required.

Photographs from Balloons or Aeroplanes Are Valuable

Photography is of little practical use for map making for military purposes except in the case of photographs taken from a balloon or aeroplane at a considerable height, which are in effect a form of map. But photographs are a valuable accessory to maps in giving a clearer appreciation of the terrain as it appears to the eye. They are of great value for showing the construction and condition of bridges, wharves, buildings, etc. Landscape sketches are usually of more value than photographs, inasmuch as they give special prominence to the important features of the terrain, omitting the mass of details which obscure the critical points.

[*In next week's article Major Bond will discuss demolitions and siege operations.*—Editor.]

Useful Feet-Miles Conversion Table for Highway Engineers

HEREWITH is a table for the conversion of feet into decimals of a mile. This table was made up and used by Clayton E. Swain in compiling data for the annual report of the Connecticut State Highway Department:

Table for Converting Feet into Decimals of Miles

Miles	0	1	2	3	4
.00	00	5280	10560	15840	21120
.01	53	5333	10613	15893	21173
.02	106	5386	10666	15946	21226
.03	158	5438	10718	15998	21278
.04	211	5491	10771	16051	21331
.05	264	5544	10824	16104	21384
.06	317	5597	10877	16157	21437
.07	370	5650	10930	16210	21490
.08	422	5702	10982	16262	21542
.09	475	5755	11035	16315	21595
.10	528	5808	11088	16368	21548
.11	581	5861	11141	16421	21701
.12	634	5914	11194	16474	21754
.13	686	5966	11246	16526	21806
.14	739	6019	11299	16579	21859
.15	792	6072	11352	16632	21912
.16	845	6125	11405	16685	21965
.17	898	6178	11458	16738	22018
.18	950	6230	11510	16790	22070
.19	1003	6283	11563	16843	22123
.20	1056	6336	11616	16896	22176
.21	1109	6389	11669	16949	22229
.22	1162	6442	11722	17002	22282
.23	1214	6494	11774	17054	22334
.24	1267	6547	11827	17107	22387
.25	1320	6600	11880	17160	22440
.26	1373	6653	11933	17213	22493
.27	1426	6706	11986	17266	22546
.28	1478	6758	12038	17318	22598
.29	1531	6811	12091	17371	22651
.30	1584	6864	12144	17424	22704
.31	1637	6917	12197	17477	22757
.32	1690	6970	12250	17530	22810
.33	1742	7022	12302	17582	22862
.34	1795	7075	12355	17635	22915
.35	1848	7128	12408	17688	22968
.36	1901	7181	12461	17741	23021
.37	1954	7234	12514	17794	23074
.38	2006	7286	12566	17846	23126
.39	2059	7339	12619	17899	23179
.40	2112	7392	12672	17952	23232
.41	2165	7445	12725	18005	23285
.42	2218	7498	12778	18058	23338
.43	2270	7550	12830	18110	23390
.44	2323	7603	12883	18163	23443
.45	2376	7656	12936	18216	23496
.46	2429	7709	12989	18269	23549
.47	2482	7762	13042	18322	23602
.48	2534	7814	13094	18374	23654
.49	2587	7867	13147	18427	23707
.50	2640	7920	13200	18480	23760
.51	2693	7973	13253	18533	23813
.52	2746	8026	13306	18586	23866
.53	2798	8078	13358	18638	23918
.54	2851	8131	13411	18691	23971
.55	2904	8184	13464	18744	24024
.56	2957	8237	13517	18797	24077
.57	3010	8290	13570	18850	24130
.58	3062	8342	13622	18902	24182
.59	3115	8395	13675	18955	24235
.60	3168	8448	13728	19008	24288
.61	3221	8501	13781	19061	24341
.62	3274	8554	13834	19114	24394
.63	3326	8606	13886	19166	24446
.64	3379	8659	13939	19219	24499
.65	3432	8712	13992	19272	24552
.66	3485	8765	14045	19325	24605
.67	3538	8818	14098	19378	24658
.68	3590	8870	14150	19430	24710
.69	3643	8923	14203	19483	24763
.70	3696	8976	14256	19536	24816
.71	3749	9029	14309	19589	24869
.72	3802	9082	14362	19642	24922
.73	3854	9134	14414	19694	24974
.74	3907	9187	14467	19747	25027
.75	3960	9240	14520	19800	25080
.76	4013	9293	14573	19853	25133
.77	4066	9346	14626	19906	25186
.78	4118	9398	14678	19958	25238
.79	4171	9451	14731	20011	25291
.80	4224	9504	14784	20064	25344
.81	4277	9557	14837	20117	25397
.82	4330	9610	14890	20170	25450
.83	4382	9662	14942	20222	25502
.84	4435	9715	14995	20275	25555
.85	4488	9768	15048	20328	25608
.86	4541	9821	15101	20381	25661
.87	4594	9874	15154	20434	25714
.88	4646	9926	15206	20486	25766
.89	4699	9979	15259	20539	25819
.90	4752	10032	15312	20592	25872
.91	4805	10085	15365	20645	25925
.92	4858	10138	15418	20698	25978
.93	4910	10190	15470	20750	26030
.94	4963	10243	15523	20803	26083
.95	5016	10296	15576	20856	26136
.96	5069	10349	15629	20909	26189
.97	5122	10402	15682	20962	26242
.98	5174	10454	15734	21014	26294
.99	5227	10507	15787	21067	26347

Screening and Concrete Plants for Building Use Gravel from Cellar Excavation

Building of Methodist Book Concern in Cincinnati Completed Rapidly with Economical Layout Including Wheeled Trestles for Support of Chutes

By W. R. HOWARD
Cincinnati, Ohio

CRAMPED by having only one side of the lot open, and that accessible only through a 14-ft. street, the contractor for the Methodist Book Concern's new building in Cincinnati managed, with a well-planned layout, to complete the second unit of the reinforced-concrete structure at the rate of 365 cu. yd. a day. Circumstances favored the contractor by providing suitable sand and gravel for concrete in the basement excavation, which reduced the quantity of aggregate to be delivered through the narrow street, yet complicated the layout problem by necessitating a screening and crushing plant on the lot. By handling all the concrete materials mechanically, and by putting wheels on the trestles supporting the chutes, the total concrete gang was cut down to fourteen men, two foremen, a fireman, and a hoisting engineer.

LIGHT WHEELED TOWERS CUT SIZE OF GANG NEEDED TO SHIFT CHUTES ON CINCINNATI BUILDING CONSTRUCTED IN HALVES

PURPOSE AND DESIGN OF BUILDING

The new building for the Methodist Book Concern is on Plum St., Cincinnati. It is of reinforced-concrete construction, with a stone and brick front, and brick fire walls on the two sides and the rear. The front half of the building is used for a retail store and offices, while the other half is used as press rooms, composing rooms, and shipping department. The building is approximately 120 x 190 ft. in plan and designed for nine stories and basement, although the present structure is only six stories high. The average story height, 13 ft. 3 in. Typical floor bays are 20 ft. by 20 ft. 6 in., of flat slab or girderless floor construction, supported on round columns having spiral and vertical reinforcing. The slab thickness ranges from 8½ to 14 in., and is the same for all the floors including the roof. On the floors there is a 3-in. concrete fill covered with 1 in. of finish.

BUILDING CONSTRUCTED IN HALVES

Only half of the building was erected at a time, the front half being erected first, in the fall of 1914. By erecting the building in two separate parts, no interruption to business was experienced by the owners except at the time of moving their presses and other machinery from the old building to the new. In erecting the front portion, enough steel was left projecting out of the floors to make a good connection and bond with the corresponding floors that were constructed later. This is shown in one of the accompanying photographs.

In the excavating of the footings for the first half, good gravel was encountered. In bidding on the job this gravel was not figured on, but it was found by tests that the sand and the gravel were suitable for concrete. A rotary screen was rigged up at that time and considerable gravel was screened, the sand being used for concrete.

EXCAVATING DERRICK MOVED ON OLD FLOOR

As there was considerably more excavation for the second half of the building, a derrick was built to handle a ¾-yd. clamshell bucket. The derrick had a 20-ft. mast and a 40-ft. boom, which gave it a fairly large working radius. While excavation for the footings and the cellar was going on, the floor of the old building was left standing in order to facilitate the moving of the derrick from place to place to excavate for all the footings. The floor was wrecked as the excavation advanced. Due to lack of storage room, about 2000 cu. yd. was sold for construction purposes. This left about 3500 cu. yd. of gravel in the basement, besides about 800 cu. yd. of rock, which was salvaged from the old stone walls. About 75 per cent of the rock was stored on a nearby lot and hauled back after the rock-crushing plant was installed.

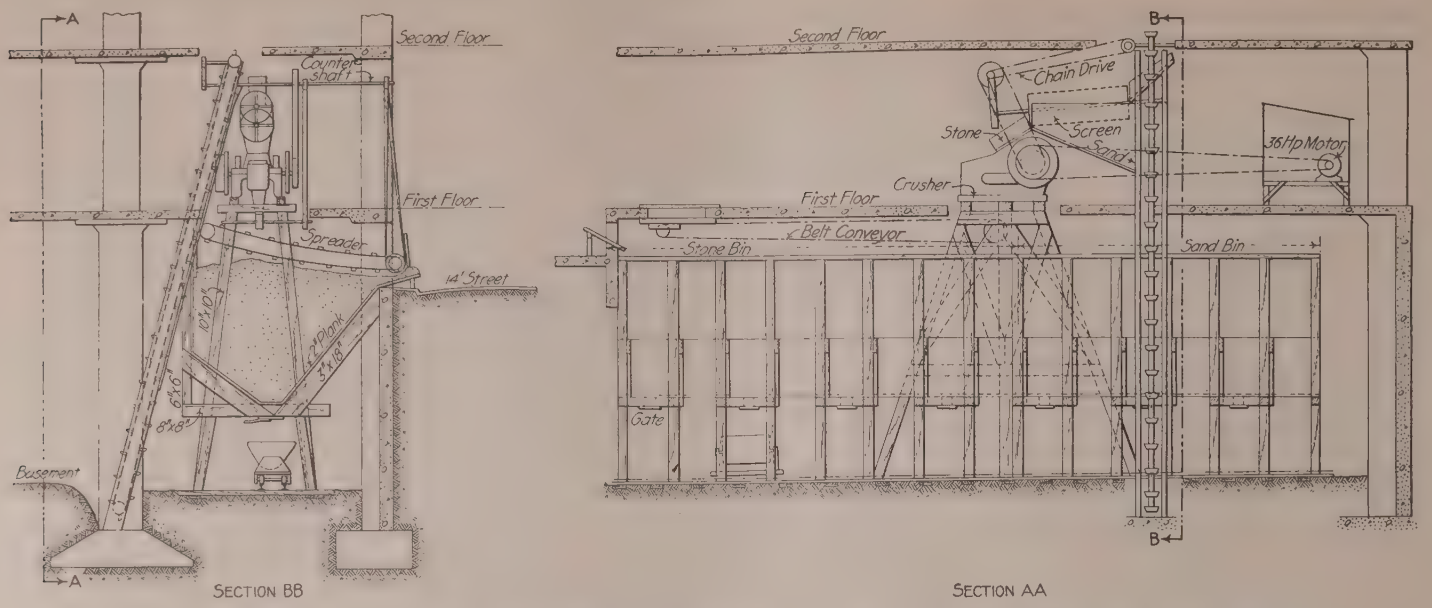
CELLAR EXCAVATION SCREENED FOR CONCRETE

In order to handle the remaining gravel and stone in the basement economically, a rather novel layout was designed, which is shown in the accompanying drawing. The equipment consisted of a bucket conveyor, a rotary sand screen, a stone crusher, a belt conveyor and a spreader. Power was obtained from a 35-hp. D. C., 220-volt motor. By means of a small dump scraper operated by a hoisting engine, the gravel was dumped at the foot of the bucket conveyor, which carried it up to the screen. The screened sand fell down chutes into the sand bin. The rock rolled down into the crusher and from the crusher it was handled the length of the stone bin by the belt conveyor. As the gravel was about half stone and half sand, about 100 cu. yd. of stone and 100 cu. yd. of sand was obtained in one day's operation.

The method of getting the rock out of the basement was similar to that of removing the gravel, only the scraper was not used. The rock was dropped into the conveyor by hand, the rock being first broken into suitable sizes that could be handled by the conveyor. The screen was so installed that it was a matter of a few moments to hoist it out of place when rock was being handled, the rock going directly to the crusher. All power to run the machinery in the plant was obtained directly or indirectly from the motor.

CRUSHER PEDESTAL SET IN BINS

The crusher sat on a pedestal constructed of 10 x 10 in. timbers which was about 20 ft. high, so as to bring the bottom of the crusher at the first-floor level when that floor was concreted. The pedestal was well X-braced and the six legs were battered in two ways, thus making a very strong structure, which was required as the type of crusher used caused heavy vibration. The bin, which was built around the crusher, aided greatly in steadying the pedestal. The sand and stone bins were about 60 ft. long, the stone bin being about two-thirds of the total length. As seen from the drawing, the bin was constructed close to the wall, so that material delivered to the job in wagons or trucks could be dumped directly into it. A 14-ft. street was the only open side of the second half of the building. There was no room for storage on it as the street had to be kept open at all times to traffic, it being a short cut between two main streets. For hauling materials dump wagons were used, which could be backed up to the building and dumped directly into the bins. When the bins filled up on the street side the ma-



CARS FED MIXER FROM BINS FILLED FROM STREET OR WITH CRUSHED AND SCREENED MATERIAL FROM CELLAR EXCAVATION

terial was carried back by means of the spreader, which did away with any hand shoveling. Material could also be dumped into the stone bin from the driveway. This place was used exclusively by the motor trucks, as it was awkward work for the trucks to back up to the building in the narrow street. As many as twelve cars of material were dumped in these bins in one day, and at no time was traffic held up.

CONCRETE PLANT REQUIRED FEW MEN

The concreting plant was designed so as to be operated at a maximum speed with a minimum amount of labor. A four-bag batch mixer was used with a floor hopper. All material was delivered to the mixer by means of side-dump cars running on 2-ft. gage track. The bodies of the cars were built so as to hold just enough sand and gravel for a four-bag batch of 1 : 2 : 4 concrete, the body of the car being divided into two departments. These cars were run up under the bins, as shown in the drawing. As there was a 1.6 per cent grade running back from the turntable, the cars were pushed back under the bins by two men, were filled and allowed to run back by gravity to the turntable. This turntable revolved on ball-bearings, and two men were stationed at this point to take care of the cars. Turning the cars through a right angle, they were pushed toward an incline where a cable was hooked onto them which pulled them up to the floor hopper. This cable was operated by the same engine that hoisted the concrete up to the floors. When the cars reached the floor hopper the contents were dumped into it and the cars ran back to the turntable by gravity. The movement of the cars was so arranged that a loaded car was always waiting at the turntable to be pulled up the incline. By having one man attend to the dumping of the cars and put the water in the mixer, two men handle cement, and one man dump the mixer, a total of eight men was sufficient for actually mixing the concrete. The hoisting engineer and fireman completed the crew. Two men were needed to handle cement because it was unloaded in the driveway and delivered to the mixing platform by means of gravity rollers on an incline from the driveway to the charging platform. Upon reaching the platform the cement was carried away and piled beside the hopper by one man, while the other man dumped the cement into the hopper. By means of the gravity rollers the cement was handled for less than half of the cost of handling by hand.

WHEELED TRESTLES MADE MOVING CHUTES EASY

The method of handling the concrete after it leaves the elevator can be readily seen from the photographs. The concrete was delivered to the floor by means of chutes. The first chute was hung from the tower by means of a 40-ft. boom. The two other chutes were suspended from wheeled trestles. Altogether three large chutes and two small hand chutes were used. The large chutes were each 36 ft. long, thus giving a working radius of about 125 ft. The wheeled trestles made it very easy to move the chutes radially. Generally in pouring concrete by the aid of chutes, high trestles are used without wheels, requiring a large number of men on the floor to move the chutes. With the wheeled trestles a gang of five men and a foreman moved the chutes and also attended to the tamping and grading of the concrete. Counting the man in the crow's nest on the tower, a gang of six men and a foreman was sufficient for placing the concrete. Altogether, for mixing and placing concrete a gang of fourteen men and two foremen was needed, together with the hoisting engineer and fireman. This made the labor cost of concreting very low when the yardage of concrete handled is considered, the average day's run being 365 cu. yd.

The hoisting of the concrete hopper, boom and chute was greatly expedited by having them fastened to a sliding frame made of two 6-in. channels. The channels slid on the two corner posts of the tower. This whole sliding unit was hoisted by means of a set of triple falls, the lead line being run down to the niggerhead of the engine.

All the equipment, both the concreting and crushing plants, was designed by J. E. Hodges, superintendent of the Ferro-Concrete Construction Company. One of the interesting features of the erection of the building was the speed and ease of the erection of the form work. The Hodges system of adjustable forms was used exclusively. By this method a floor was easily erected and concreted every six working days. The total area of form work per floor for the second part of the building was approximately 19,000 sq. ft.

The building was designed by S. Hannaford & Son, architects, of Cincinnati. The general contractor for the job was the Ferro-Concrete Construction Company, also of Cincinnati.

Automobiles Run on Four Cents a Mile in Supervising Road Work

THREE low-priced cars have been run for nineteen months at an average of 4.13 cents per mile in supervision work on the Washington-Atlanta highway, according to E. W. James, chief of road maintenance of the Office of Public Roads. The car which has made the last mileage averaged 28.4 miles a day on a basis of 30 days a month, while one of the other cars averaged just 50 per cent more than this. Transportation per mile of road under supervision formerly cost 52 cents a month for livery. With these cars it cost 20 cents a month. The chief saving, however, was in the time on the road of the men using the cars.

The figures published by Mr. James do not include labor. Those for two of the three cars correspond very closely, while those for the third car are slightly higher because of storage charges and greater tire costs. The gasoline for one car cost only 81 per cent of that for the other two, but storage and miscellaneous charges on this car were high. Of the average operating cost of 4.13 cents per mile, 35.7 per cent was miscellaneous, 24.8 per cent was for gasoline, 20.3 per cent for tires, 12.6 per cent for storage, 5.6 per cent for oil and 1 per cent for grease. The costs cover the period from the end of May, 1914, to the beginning of the present year.

Forest Service Is Taking Census of 1915 Lumber Production

The U. S. Forest Service is making a census of the 1915 lumber production in cooperation with the National Lumber Manufacturers' Association. A preliminary statement will be made about May 1. The census bureau was too busy this year to take this census.

How the Forest Service Bridges the More Remote Stream Crossings

Inexpensive Suspension Bridges Are Built Across Mountain Streams of the Northwest Under Unique Construction Difficulties

ADMINISTERING the affairs of national forests in the Northwest has in recent years involved the construction of seventy-nine bridges, varying in type from light cable footbridges to timber structures designed for heavy traffic. Seven suspension bridges have been built in the states of Oregon and Washington, and in several cases the structures were required at points so remote that the greatest problems and the major part of the cost have been in delivering materials to the site.

Only limited funds have been available for this work, and in many cases the difficulties were such that it has been feasible to construct the bridges only because the supervisor and his rangers have devised ingenious schemes. When the need for a new bridge becomes evident an examination and report is made by the supervisor or his representative, and often when construction difficulties preclude doing the work by contract, the Forest Service designs and builds the structure with its own funds and forces.

TRANSPORTATION DIFFICULTIES

In the case of the Thunder Creek bridge, a suspension bridge with a 96-ft. span, the heavy snows of the region made it necessary to design for a snow load of 125 lb. per square foot. This called for two $1\frac{3}{4}$-in. suspension cables, 200 ft. long, each weighing 1170 lb. These presented a serious transportation difficulty, as the only access to the site was over a rough mountain trail 30 miles in length.

An effort was first made to deliver these cables to the site on pack animals by distributing the weight on five mules. This attempt failed, the entire train of mules going down under the combined weight of the cable and the strain of keeping their footing on the rough and narrow trail. A second attempt was made by twenty men, who packed the cable in on their shoulders for some 13 miles over the most dangerous part of the trail, each man carrying a length of 10 ft. In this manner after considerable hardship the cable was delivered to the site successfully. In spite of the difficulties, however, the total cost of the completed structure was only $2,515, of which $500 was contributed by Whatcom County.

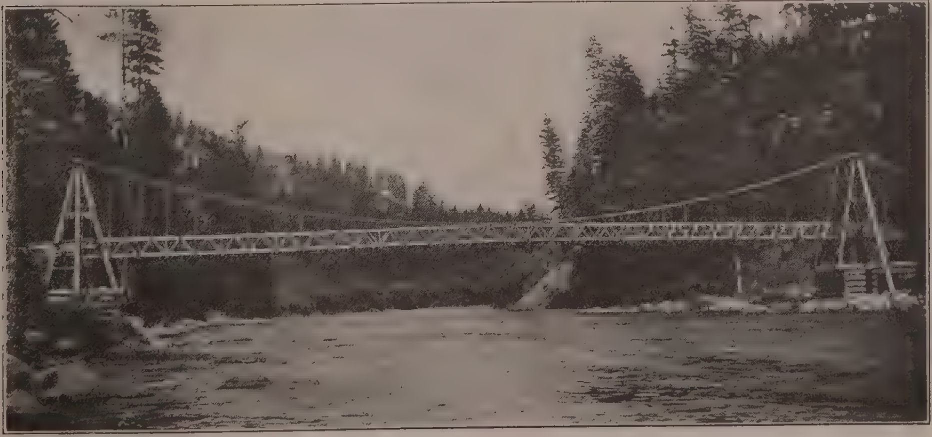
In the case of the Skagit River bridge near Ruby Creek, an old wooden truss erected at the site by miners was used as falsework during the building of the new structure, and was then removed. The new bridge has a span of only 84 ft., but stands 150 ft. above the water, its towers being founded on rock cliffs at the entrance to what is known as Canyon Diablo. The depth of water in this canyon at some points is as much as 80 ft., with only 14 ft. between the tortuous, perpendicular walls. Cedar for bridge-floor and side rails was not available near the site, and it had to be rafted down from a point 6 miles upstream. This operation was dangerous, not only on account of hidden rocks and rapids, but because of the rapidly increased current at the approach of the mouth of the canyon. The work was completed, however, without accident.

WENATCHEE SUSPENSION BRIDGE

When decision to build the Wenatchee suspension bridge was reached, bids were asked from a number of companies on a structure of 190 ft. between towers, plans for which were prepared in the office of the district supervisor. The lowest bid on the construction work alone, the Forest Service to furnish all material, was $3,266. This was much more than could be afforded for this particular job, so the work was undertaken by Forest Service forces. Under the supervision of the ranger who prepared the designs, the structure was built at the following cost:

Material	$1,338.92
Hauling	91.82
Temporary labor	799.94
Rangers' labor, including supervision	159.16
Subsistence	242.12
Total	$2,631.96

This bridge, shown in the accompanying photograph, is located about 3 miles northeast of Chiwaukum, Wash., a station on the Great Northern Railway. The towers are 38 ft. in height from lower edge of sill to top of cap, and they support two $1\frac{1}{2}$-in. crucible-steel cables with wire centers. These cables pass over cast-iron saddles driftbolted to the tower caps, and are anchored by means of deadmen at a sufficient distance from the towers to allow them to swing on the same angle at both ends of the structure. The tension is adjusted by two 24-in. turnbuckles at the west end. The camber in the center of the span is 1 ft.



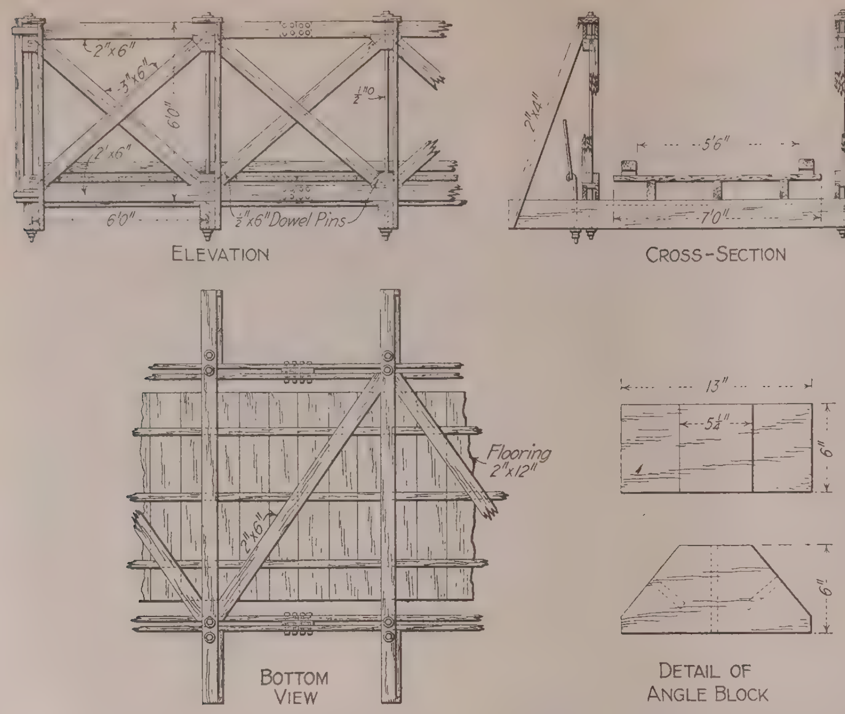
FOREST SERVICE SUSPENSION BRIDGE OVER WENATCHEE RIVER SPANS 190 FEET

DIABLO CANYON BRIDGE IS 150 FEET ABOVE THE WATERS OF THE SKAGIT RIVER

The cribs and towers were erected first. A slender cord was then passed across the river in a boat, and with the cord a stout wire was drawn over. To the wire one of the $\frac{1}{2}$-in. guy cables was attached, and with this, by the aid of a home-made capstan, the large cables were drawn across the stream and securely anchored to the deadmen. The cables were brought to their proper position by means of the turnbuckles. A carriage was then slung from the cables, from which workmen could put on the suspender rods which support the floor structure.

The floor of the bridge is supported by $\frac{1}{2}$-in. rods and $\frac{3}{8}$-in. cables fastened to the main cables by $1\frac{1}{2}$-in. Crosby clamps at 6-ft. intervals. Towers and cribs are constructed of Douglas fir, cut at the site, the bark being removed before the timber was placed in the structure. The specifications required the cribs to be placed on solid foundation near the water's edge. Daps were required at all angular timber joints so that a sufficient depth to secure the necessary nailing surface was provided, and the number of 30d nails or $\frac{7}{8}$-in. driftbolts were specified at each important joint. Four guy cables were used for steadying the towers, two being used on each end of the span with the tower ends fastened on the bank of the stream, one above and one below. Rock was used to fill the cribs, and about 4 cu. yd. of it was placed around the main braces and ends of each crib on the upstream side of the structure. For the latter purpose no pieces weighing less than 100 lb. were permitted.

On each bank the anchorage for the cables consisted of a cedar log, 33 in. in diameter at the small end and 20 ft. long, which was placed in a pit 7 ft. deep. A sheet of soft steel 6 in. wide and 3 ft. long, bent to fit the curvature of the log, was fastened directly under the cable at the points of heaviest strain, and the cables were passed twice around the log. Rocks of suitable size were put in the pit before the deadman was placed, after which the excavation was entirely filled with rocks, 25 per cent of



STIFFENING TRUSS DETAILS FOR COWLITZ RIVER SUSPENSION BRIDGE

which weighed not less than 200 lb. each.

The towers were given a brush treatment of creosote, and the whole structure was painted a dark green with creosote shingle stain. The ironwork was covered with asphalt paint. Wire netting on the sides to prevent sheep from falling off is removed and rolled up in the fall and replaced again in the spring. After being in use four summers, during which time more than 100,000 sheep and numerous pack and saddle animals crossed the bridge, it is reported that no settlement can be noticed.

COWLITZ BRIDGE

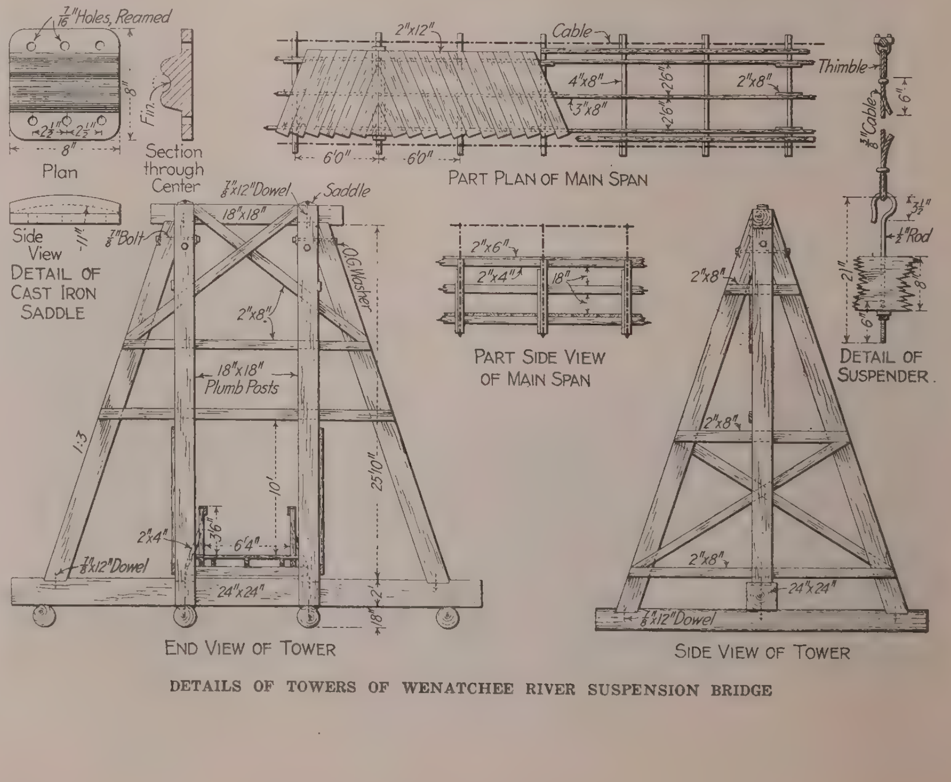
For the Cowlitz River crossing a suspension bridge was decided upon which would have a span from tower to tower of 180 ft. The towers are of hewed timber built on cribs 18 ft. high. Two 2¼-in. cables were used, each having a total length from anchor to anchor of 373 ft. On account of the size of the main cables, which were of crucible steel with wire center, it was impracticable to use a turnbuckle for adjusting the strain, and this strain was provided for by the use of open bridge sockets babbitted to the cables at each end and made fast to the anchorage by 1⅝-in. cables. The sockets are adjusted to a take up of 18 in., which is considered sufficient for any needed adjustment of the main cables.

On one end of this structure it was possible to anchor the cables in solid rock, but at the other end a solid block of concrete, weighing approximately 37 tons, was cast in a pit with the top of the concrete 10 ft. below the surface. Eyebolts 3½ in. in diameter were placed in this concrete block, and to these were attached the 1⅝-in. cables carrying the bridge sockets. This extensive anchorage process was considered necessary on account of the loose shifting formation at this point combined with the heavy strain.

FLOOR AND STIFFENING TRUSS DETAILS ARE DESIGNED TO PREVENT VIBRATION

The floor is 5½ ft. wide between wheel guards, and is supported from the cables by the usual suspension system. From top of rail to the floor timbers a system of 2 x 12-in. diagonal braces is placed in pairs, connected with dowel pins and braced from rail to floor with vertical tie rods. It is claimed for this type of construction that practically all vibration is eliminated, even when large logs are dragged over the bridge. Precaution was taken against deterioration of those parts of the cable placed underground. Exposed steelwork, on account of the variable weather conditions, required frequent and thorough application of oil and white lead. All manufactured material used in this bridge was hauled in winter over 43 miles of rough road from the nearest railway station.

The work of the Forest Service in the Northwest in District 6, comprising Oregon, Washington and Alaska, is in charge of George H. Cecil, district forester, whose headquarters are at Portland, Ore.



DETAILS OF TOWERS OF WENATCHEE RIVER SUSPENSION BRIDGE

Nick and Break Test for Steel Rails Advocated

R. W. Hunt and C. W. Gennett, Jr., Present Results Tending to Demonstrate Advantages of Such Tests for Both Railroads and Manufacturers

APPLICATION of the nick and break test to a large tonnage of standard A.R.A. 90-lb. rails, type *A*, ordered by a leading railroad of the Middle West, was made by the Algoma Steel Corporation, of Canada, and the results tend to show that a decrease in the number of rails rejected as compared to the specifications of the American Railway Engineering Association is effected, but with greater protection for the railroad. In a fully illustrated paper of 25 pages presented by R. W. Hunt and C. W. Gennett, Jr., before the annual convention of the latter association at Chicago on March 21-23, the advantages of this test are clearly explained. The conclusions reached are here given, after stating the specifications used for the test.

The specifications provide that the test pieces which have successfully withstood the drop test and also a piece representing the top end of all other top rails shall be nicked and broken. If the fracture shows interior defect the "A," or top rail of the ingot, shall be rejected, and a piece shall be cut from its bottom end to represent the "B" or second rail of the same ingot. This piece shall then be nicked and broken, and if its fracture shows interior defect, the rail represented shall be rejected. The testing by nicking and breaking shall proceed progressively in this manner on all the rails of each ingot, if necessary, and they shall be accepted or rejected according as the fracture of the test piece representing them shows interior defects.

CONCLUSIONS

The most important conclusions which can be deduced from the results of these tests are:

1. That the application of the nick and break test specification results in a distinct saving to the mill in the number of rails rejected as against those that would be re-

jected under the American Railway Engineering Association specification. These rejections have been reduced from 5.56 per cent to 2.98 per cent, resulting therefore in a saving to the mill of rejected rails amounting to 46.4 per cent.

2. That the application of the nick and break test specification is a greater protection to the railroad than would be the American Railway Engineering Association specifications, for the rejections under the former include 1.33 per cent (of the total number of rails rolled) which would have been accepted under the American Railway Engineering Association specification. Thus, of the total number of rails rejected under the nick and break specification, 44.6 per cent would not have been rejected under the American Railway Engineering Association specification, so that practically one-half of the rails rejected under the former specification would have been accepted under the latter, and laid in the track.

3. If, as has been shown by public records, the number of rails that fail in service and have to be replaced because of unsound or unhomogeneous metal, represents nearly one-half of the total number of failures occurring on the railroads each year, obviously then, by the application of the nick and break test specification, which is a protection against unsound and unhomogeneous metal, a material reduction in the number of these rail failures would be effected.

Test Made of Model Weir

Laboratory Investigation Thought to Furnish Encouragement as to Reliability of Deduction from Small-Size Dams

By BEN D. MOSES
El Paso, Tex.

AS AN INVESTIGATION of the flow of water over model dams or weirs, the following description of a test made on a very carefully constructed model and presented as a thesis by J. W. Dismukes, a senior at the University of California, is quite worthy of note.

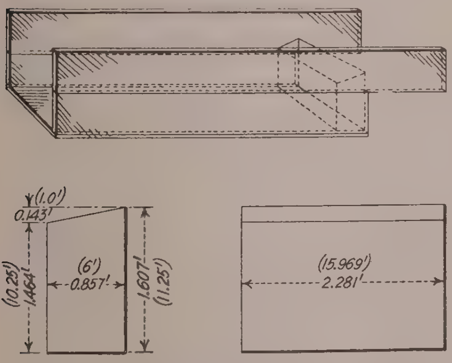


FIG. 1—DIMENSIONAL SKETCH OF WEIR

In seeking a dam or weir after which to make his model, Mr. Dismukes finally chose one of those calibrated at Cornell University in 1903 and described in Water Supply Paper 200 of the U. S. Geological Survey. That known as Series 39 and called the Dolgeville model seemed most fit, as it could be most readily reduced to his scale, and besides being of simple construction, had a fairly consistent curve for the coefficient c. All dimensions on the Cornell weir were reduced 7:1, resulting in a model of 2.281 ft. instead of 16 ft. crest length. (See Fig. 1.) All conditions of approach and suppression were reproduced as nearly as possible. Ordinary pine lumber was used for the flume and approach, and redwood for the weir itself, the greatest care being used with all dimensions.

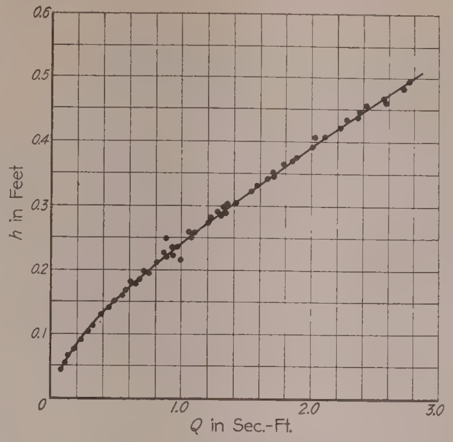


FIG. 2—CALIBRATION CURVE FOR MODEL OF DOLGEVILLE MODEL

The quantity of water was measured volumetrically in a previously calibrated concrete tank 7 x 7 x 12 ft. fitted with a hook gage reading to millimeters. A special carriage mounted on rollers served to deflect the water from one tank to the other. The time of cutting the stream was caught with a stop watch, and altogether the operation was most accurate. Rubber tubing leading from the bottom of the approaching flume to a well supplied with a hook gage served as an effective means of obtaining the head on the weir. Still carrying out the 7:1 relation, the heads were taken at two places, one 1.47 ft. and the other 2.29 ft. above the weir.

TABLE SHOWING COMPARISON BETWEEN ACTUAL EXPERIMENTAL QUANTITY OVER WEIR AND THAT OBTAINED BY FORMULA $Q = n^{5/2} q$

h = head on Cal. model, ft.	$H = 7h$ = head on Cornell model	q = quantity over Cal. model, sec.-ft.	Q = quantity over Cornell model from their data	Q^1 = quantity over Cornell. Weir computed from $Q^1 = 7^{5/2} q$	Difference, $Q^1 - Q$	Per cent difference, $(Q^1 - Q)/Q$
0.05	0.35	0.092				
0.10	0.70	0.260	33.0	33.61	0.6	1.8
0.15	1.05	0.480	61.6	62.10	0.5	0.82
0.20	1.40	0.760	94.0	98.40	4.4	4.69
0.25	1.75	1.060	130.0	137.10	7.1	5.46
0.30	2.10	1.380	169.0	178.9	9.9	5.85
0.35	2.45	1.720	209.0	222.5	13.5	6.56
0.40	2.80	2.060	252.5	266.6	14.1	5.60
0.45	3.15	2.430	298.4	314.1	15.7	5.26

After the weir was installed, leveled and calked a few preliminary runs were made, after which a series of 72 runs was made, the head and quantity being obtained for each run. These have been plotted in Fig. 2, and the curve attests the accuracy of the observations. There remains now to study this curve, and for this purpose nine points were chosen, using the experimental data.

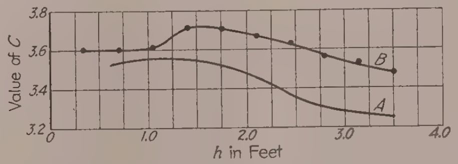


FIG. 3—VALUES OF c FOR CORNELL MODEL, A, AND CALIFORNIA MODEL, B

Curve A, Fig. 3, gives c as obtained at Cornell, and curve B that for the model at California, the head multiplied by 7 in each case for the purpose of comparison. It is to be noticed that above heads of 1.4 ft. on the Cornell model (or 0.2 ft. on the California model) the curves are at the same general type, and that the coefficient for the smaller weir is greater than that for the larger. This difference seems rather to be in favor of than against the principle, since it has been shown in the writer's article in the Engineering Record of Feb. 19, page 246, that on models of less than 7-ft. crest this actually will occur.

Now let us apply the principle $Q = n^{5/2} q$, in which Q is the quantity over the Cornell model; q that over the California model for the corresponding head, and n, the reduction factor in our case 7. (See Engineering Record of Aug. 16, 1913, page 193, "Flow Over Model of Sunol Dam.") Then $Q = (7)^{5/2} q = 129.6\, q$.

The accompanying table shows the results, and is self-explanatory, while the curves in Fig. 4 are a graphical representation. This is of course the result of one test only, and in spite of the fact that a difference is encountered of some 6 per cent, the consistency of the results is encouraging.

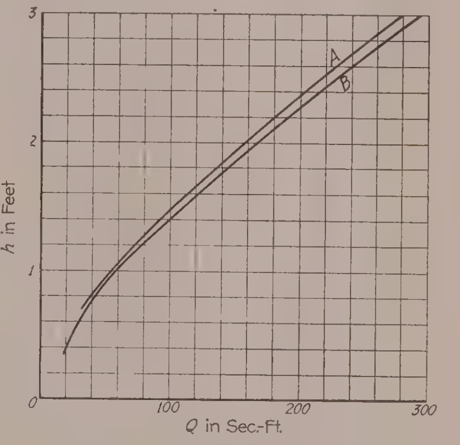


FIG. 4—CALIBRATION CURVES FOR THE TWO MODELS, A AND B

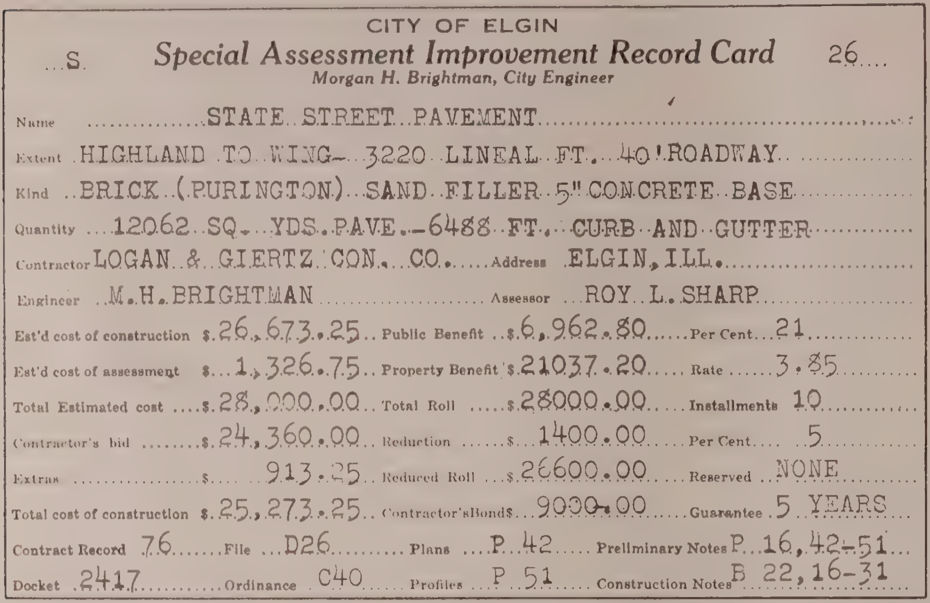
Find Wooden Grillage Foundation Rotted

Settlement of the foundations of a building in Milwaukee adjacent to a sewer excavation was found to be caused by stone piers sinking through a rotted wooden grillage. In the contract of John F. Casey for an intercepting sewer on the east side of the Milwaukee River all open trenches were supported by steel sheet piles, driven below the subgrade in one operation after the material for 6 ft. had been removed. The piles had not been pulled until after the trenches had been entirely backfilled. With one exception no caving occurred, according to the annual report of T. Chalkley Hatton, chief engineer of the Sewerage Commission, under whose direction the work is being prosecuted. After the steel piling had been pulled in front of 537 Edison Street the stone piers supporting the front of this building settled. Upon investigation it was found that these piers had been supported upon wooden grillage, which was entirely rotted, and the slight outward movement of the supporting earth, doubtless due to the excavation of the trench in the street, had transmitted sufficient movement to these piers to drop them through the rotten wood upon which they were resting.

City Improvement Records on 4x6-Inch Cards

City Engineer Evolves System to Enable Him to Answer Questions Instantly on Progress of Special Assessment Work

THE engineer for the board of local improvements of any Illinois city doing a considerable amount of public improvement work by special assessment is constantly being called up to furnish, either for his own use or for the advice of others, a vast amount of general information relating to the various public improvements of his city. Where the obtaining of such information may require the reference to board minutes, council proceedings, court records, filed contracts, etc., it often involves much trouble, annoying delays and loss of valuable time. This is especially true where those records may have been irregularly or carelessly kept, or when they have been filed in other departments or even in other cities, as is frequently the case in regard to court records. Some years ago M. H. Brightman, city engineer of Elgin, Ill., desiring to eliminate the continual reference to original records for improvement data and to retain such data in convenient form in his own office, devised a system of record cards which he has found to be of great value as a time and patience saver. Mr. Brightman submitted a paper describing his card system of keeping such a record recently before the Illinois Society of Engineers. This paper is reproduced practically as given.



CITY OF ELGIN

..S. *Special Assessment Improvement Record Card* 26...

Morgan H. Brightman, City Engineer

Name ....STATE STREET PAVEMENT

Extent HIGHLAND TO WING- 3220 LINEAL FT. 40' ROADWAY

Kind BRICK (PURINGTON) SAND FILLER 5" CONCRETE BASE

Quantity 12062 SQ. YDS. PAVE.-6488 FT. CURB AND GUTTER

Contractor LOGAN & GIERTZ CON. CO. Address ELGIN, ILL.

Engineer M. H. BRIGHTMAN Assessor ROY L. SHARP

Est'd cost of construction	$ 26,673.25	Public Benefit	$ 6,962.80	Per Cent	21
Est'd cost of assessment	$ 1,326.75	Property Benefit	$ 21037.20	Rate	3.85
Total Estimated cost	$ 28,000.00	Total Roll	$ 28000.00	Installments	10
Contractor's bid	$ 24,360.00	Reduction	$ 1400.00	Per Cent	5
Extras	$ 913.25	Reduced Roll	$ 26600.00	Reserved	NONE
Total cost of construction	$ 25,273.25	Contractor's Bond	$ 9000.00	Guarantee	5 YEARS

Contract Record	76	File	D26	Plans	P. 42	Preliminary Notes	P. 16, 42-51
Docket	2417	Ordinance	C40	Profiles	P 51	Construction Notes	B 22, 16-31

PRINCIPAL FACTS AND FIGURES REGARDING IMPROVEMENTS ARE RECORDED ON FACE OF 4 X 6 INCH CARDS—ONE CARD USED FOR EACH IMPROVEMENT

How System Works

All the principal facts and figures concerning the different improvements of the city are recorded on standard 4 x 6-in. filing cards printed with suitable headings for that purpose, one card being used for each improvement. The entire system, alphabetically arranged and filed in a small metal case, occupies an inconsiderate space in the corner of the office desk, and yet is always at hand for instant reference, furnishing without delay or inconvenience the answer to a thousand and one questions and acting as a memorandum and guide for the engineer in carrying on his work.

On the face of each card at the top, blank spaces are provided for the name of the improvement, its location and extent, general nature of its construction and the principal quantities involved. In reference to a brick pavement improvement, for example, after the name of the improvement would appear the street in which the work was laid, the points to and from which it extended, the length and width of roadway improved, kind of pavement, including nature and thickness of base, make of brick and kind of filler, together with the yardage of pavement and the lineal feet of curb or curb and gutter, and any other quantities of major importance that may have been included in the improvement. Following the above are spaces for the name and address of the contractor doing the work, and the name of the engineer under whose supervision the improvement was made and the name of the special assessor preparing the assessment roll.

Below and along the left side of the card are blanks for the following amounts, in the order named: Estimated cost of construction; estimated expense of making and collecting the assessment and other lawful expenses; total estimated cost of the improvement; contractor's bid; cost of extra work, and total actual cost of construction. Opposite these amounts are to be recorded the following: Amount assessed as public benefit, or the "city's share," and its percentage of the total amount of roll; amount assessed against property benefited and the average rate so assessed per lineal foot of normal frontage; total amount of assessment roll and the number of installments into which the assessment is divided; amount and percentage of reduction applied to the original roll, if any, after completion of improvement, and amount of the contractor's bond and length of time for which the work was guaranteed.

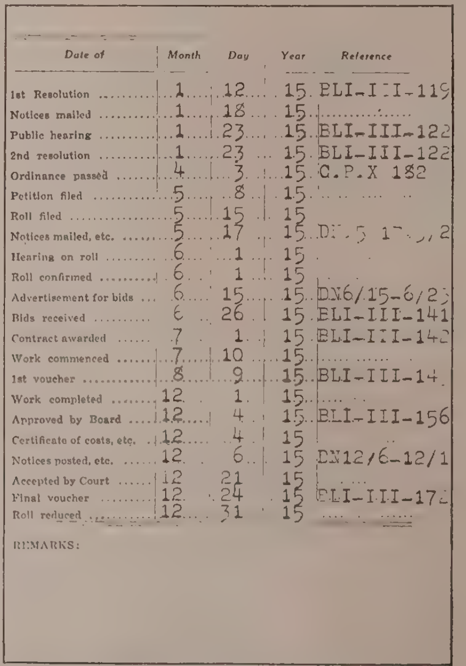
Important Dates Recorded

On the reverse of the card are spaces for entering the dates of important steps in the progress of the improvement as follows: Adoption of the first resolution by the board; mailing of notices of public hearing; holding of public hearing; adoption of separate resolution; passage of ordinance; filing of petition in the county court; filing of assessment roll; notices mailed, published and posted for hearing in court; court hearing on assessment roll; confirmation of assessment roll; advertisement for bids; bids received; awarding of contract; work commenced; issuance of first voucher to contractor; work completed; improvement approved by board; filing of certificate of costs, etc., in county court; notices published and posted for court hearing on acceptance of improvement; improvement accepted and revised roll confirmed; issuance of final voucher and reduction of original roll.

Opposite the column of dates is another column at the top of which Mr. Brightman, for want of a better heading, has placed the word "reference." He has used this column to good advantage by noting in the space opposite each date, initials and numbers referring to minutes of board meetings, council proceedings, etc., that may be connected in some way to the date opposite. For instance, opposite the date of the adoption of the first resolution, B. L. I. III, 125, means that on page 125, Vol. III of the proceedings of the board of local improvements is recorded the adoption of such resolution. D. N., 1/16-1/26, opposite the date of the advertisement for bids would indicate that such advertisement was officially made in the *Daily News* from Jan. 16 to 26.

At the bottom of the card on the reverse side a considerable space has been left blank for noting remarks of any nature deemed necessary in connection with the improvement. In this way each card furnishes a record of the bulk of the general data relative to the improvement which it represents. While this data covers all that is most commonly required, yet it is evident that occasional reference must be made to more detailed and complete records for information that could not possibly be recorded in this way.

To facilitate this further reference work, blanks are provided on the face of the card



Date of	*Month*	*Day*	*Year*	*Reference*
1st Resolution	1	12	15	BLI-III-119
Notices mailed	1	18	15	
Public hearing	1	23	15	BLI-III-122
2nd resolution	1	23	15	BLI-III-122
Ordinance passed	4	3	15	C.P.X 182
Petition filed	5	8	15	
Roll filed	5	15	15	
Notices mailed, etc.	5	17	15	D[illegible] 5 1[illegible]/2
Hearing on roll	6	1	15	
Roll confirmed	6	1	15	
Advertisement for bids	6	15	15	DN6/15-6/2
Bids received	6	26	15	BLI-III-141
Contract awarded	7	1	15	BLI-III-14
Work commenced	7	10	15	
1st voucher	8	9	15	BLI-III-14
Work completed	12	1	15	
Approved by Board	12	4	15	BLI-III-156
Certificate of costs, etc.	12	4	15	
Notices posted, etc.	12	6	15	DN12/6-12/1
Accepted by Court	12	21	15	
Final voucher	12	24	15	BLI-III-17
Roll reduced	12	31	15	

REMARKS:

REVERSE SIDE OF CARD CARRIES DATES AND REFERENCES at the bottom to be filled in with court docket number and the file or index numbers referring to other records in the engineer's office, including field notes, plans, profiles, specifications, ordinances, contract records and copies of all legal or other papers and documents connected with the improvement. An index letter and number are placed at the upper corners of each card to aid in filing and for cross referencing.

Give Conclusions on Activated Sludge Tests

T. Chalkley Hatton and William R. Copeland Make Elaborate Report of Findings at Milwaukee Testing Station

NUMEROUS tests have been carried on at Milwaukee to determine the variations under which the activated sludge process of sewage treatment could be used to the best advantage. The conclusions reached are summarized in the annual report for 1915 of T. Chalkley Hatton, chief engineer, and William R. Copeland, chief chemist, of the Milwaukee Sewerage Commission. The following notes are abstracted from the report:

Comparing the fill-and-draw method with the continuous flow method, there is no material difference measured in terms of required air, cost of aeration, volume of activated sludge required, clarification, nitrates and stability obtained, and the removal of bacteria and organic matter. In terms of cost of construction and operation the continuous flow method, the report states, is the superior method.

In order to maintain clarification and stability and to remove at least 95 per cent of the bacteria from the raw sewage, the nitrogen cycle must be carried far enough to develop from three to five parts of nitrates per million. Carrying this cycle further increases the value of the sludge, but whether this increase is greater or less than the cost of the increased air employed is a matter still to be determined.

The most economical ratio between diffusing and tank surface has not been determined. The ratios thus far used at Milwaukee have run from 1:6.5 to from 1:8.5, and the results have given no indication as to which is the best.

Many Diffusers Tested

The best method of diffusing the air has not been definitely determined, although there are many which might be said to be available. (See Engineering Record, Feb. 19, 1916, page 255.) As the use of the process becomes more general this problem will doubtless be satisfactorily solved. The open air jet reduces the pressure of air, but reduces its efficiency, owing to the bubbles being too large. This objection might be overcome by reducing the size of the orifice. An orifice 1/1000 in. in diameter under a 5-lb. pressure discharges air bubbles 1/32 in. in diameter. It is problematical whether such minute orifices could be practically operated, because of the tendency of the small particles of dust carried in suspension in the air to stop them up. Another objection to the open air jet is the tendency to clog the air feed with sludge drawn into the pipe through the orifice when the air is shut off. Great difficulty has been found in this respect in operating the open jets.

Filtros plates, if furnished of uniform porosity, are fairly satisfactory, in fact the most satisfactory agent tried. However, the bubbles discharged are too large to produce the greatest efficiency, and the loss of pressure due to friction through the plate is expensive. This latter might be reduced by making the plates thinner and reinforcing them with wire similar to window-glass reinforcement. Filtros plates are now manufactured 1½ in. thick and 12 in. square, and are sold upon the basis of passing, when dry, a certain quantity of air in cubic feet per minute under a pressure due to 2 in. head of water. This quantity varies directly as the porosity of the plate. The pressure increases from ten to twelve times when the plate is wet. A plate passing, when dry, 2 cu. ft. of air per minute, loses under a 2-in. water pressure about ¾ lb. initial pressure in the passage of the air through the plate, and in addition ¼ lb. for each cubic foot of air passed per minute per square foot of surface.

So far as observations at Milwaukee have gone there is no difficulty in maintaining a clean plate, providing clean air is delivered to it. The sludge which might rest upon the surface of the plate is not absorbed when the air is shut off. It may be in time that the porosity of the plate might be reduced by bacterial growths requiring sterilization for their removal.

The monel metal cloth has been tested but a short time. The observations indicate that smaller bubbles issue from the surface of the cloth than from the filtros plate, although the former is more porous than the latter. This is probably due to the smooth surface of the cloth to which bubbles cannot hang while being built up, as is the case with the rough granular surface of the filtros plate. There is, of course, much less frictional loss through the cloth than through the plate.

Time and Air Volume Variations

The purification of sewage obtained varies decidedly with the volume of air applied. Small volumes applied for five or six hours do as well as larger volumes applied for three or four hours, but the time of aeration required to obtain a like effluent does not vary directly with the volume of air applied per unit of time. There is also a limit to the volume of air applied per period of application, below which it is not possible to secure any significant degree of purification. If less than 1 cu. ft. of air per gallon of sewage treated be applied for a period of four hours, the degree of purification rapidly decreases until little or none is effected, but if the period of application was continued a sufficient length of time any degree of purification required might be obtained. In any case the question of efficiency, volume of air required and period of application is affected largely by the degree of purification desired, and this degree should be established as one of the first steps in designing a disposal plant in which this process is to be employed.

The sludge produced by the process drains out upon the ordinary sludge drying beds in less than one-half the time of the Imhoff tank sludge, but this dewatering is accomplished differently; the first liquor removed from the sludge passes downward through the bed, upon the surface of which the sludge settles, whereupon the remaining liquor rises on the top of the sludge and must be drawn off. The sludge has no apparent odor. Its moisture content can be reduced from 98 per cent to 94 per cent and its volume decreased 40 per cent, by pressure due to a 26-ft. head of water.

Literature

For the Civil Engineer and Contractor

New Publications

Water Supply Papers, U. S. Geological Survey. Paper, 6 x 9 in.; illustrated. Washington, Government Printing Office.

Surface Water Supply of the United States, 1913. Part 9—Colorado River Basin. Paper No. 359; 260 pages.

A Water-Power Reconnaissance in South-Central Alaska.—Paper No. 372, 173 pages.

Surface Water Supply of the United States, 1914. Part 5—Hudson Bay and Upper Mississippi River Basin. Paper No. 385; 247 pages.

The American Year Book, 1915. A Record of Events and Progress. Edited by Francis G. Wickware, B. A., B. Sc. Cloth, 5 x 8 in.; 862 pages. New York and London, D. Appleton & Company. $3 net.

This is the sixth annual issue of a book designed to meet the needs of writers and seekers for facts. It contains in addition to general information chapters on engineering, mathematics and astronomy, geology, chemistry, physics, forestry, mineral industries and other subjects of interest to engineers, recording the progress made during the year.

Books Reviewed

Live Load Stresses in Railway Bridge—Formulas and Tables

Author, George E. Beggs, A. B., C. E., assistant professor of civil engineering, Princeton University. Cloth, 6 x 9 in., 123 pages; illustrated. New York, John Wiley & Sons, Inc. $2 net.

This textbook, if judged by the fifty-eight pages of analysis of influence lines, with formulas and examples of their application, claimed to "give an easy and exact solution of the maximum live-load stresses in any structure whose influence lines can be drawn," can hardly be conceded to have established its claim, nor is it a real contribution to the practical analysis of live-load stresses. Present methods and formulas, used in connection with moment and load tables giving partial sums, are shorter and simpler, and avoid the danger introduced by the author in the use of formulas which are manipulated until their physical significance is entirely lost.

If, on othe other hand, the book be judged by the fifty-six pages of tables, there is no question that students and engineers not already in possession of this material, much of which is not new, will find useful data, especially in the collection of live-load moment and shear values for girder and truss bridges for Cooper's loadings.

It might be questioned why three Cooper's loadings (E40, E50 and E60) are each given complete and separate tables, when the well-known ratios between them (not mentioned in the book, however) can easily be applied with a single setting of the slide rule to find final stresses for any system from values found for any other. The examples seem easy because all dimensions are in even feet, for which the tables are computed. Nothing is said about interpolation, which is, of course, generally necessary and increases the amount of computation required. The double interpolation necessary in using Tables 10 to 21 inclusive is not explained. For the usual uneven span lengths this interpolation takes considerable time; graphical diagrams for such variables are, therefore, much superior.

It is unfortunate, also, that the logic of arrangement was not more carefully considered. The text is divided into eleven articles, and in several cases reference is made to later diagrams or to later theoretical relations not yet developed. This is particularly noticeable in the discussion of equivalent uniform loads, the definition and explanation of which, given in Article 9, should have followed Article 3.

In fact, the great usefulness of equivalent uniform loads, especially for long-span and higher structures, is not adequately presented. The claim of the author that his method and equations are especially advantageous for the complicated higher structures is not demonstrated. The only example given is the simple case of the three-hinged arch, and it can be shown that the usual graphical method using groups of wheels and their centers of gravity plotted on a tracing-cloth rider, will give the stresses more simply and rapidly. The general criterion $\Sigma Ws = o$ for influence line use, will give the position of loading for maximum stress much more directly than the author's formula.

While appreciating the originality of the fundamental formulas and the great amount of time spent in the operation of an adding or computing machine to prepare the complete tables given (some of which are carried to eight significant figures!), the conclusion cannot be avoided that, although in the classroom the book may be useful as a basis for mathematical exercise, for actual application by the designing engineer the new methods proposed have no clearly proved advantages over the best present methods.

Letters to the Editor

Comment on matters of interest to engineers and contractors will be welcomed

Shall the American Society of Civil Engineers Move Its Headquarters?

SIR: Some time ago you asked me for an expression of my personal opinion on the question, Shall the American Society of Civil Engineers move its headquarters? Since reading your editorial of Feb. 5, and your plea for an "open mind" in deciding the question, I feel what I want to say on the matter would be a substantial repetition of what you have already said. I have also read the objections which are raised against the proposed change by some of the members of the society. It does not seem to me that the objections which can and have been raised are such as to warrant the members of the society in voting against the proposed change.

The question, as Past-President Hunter McDonald states, was taken up as early as January, 1915, in an informal talk between Messrs. McDonald and Herschel. It was soon after brought to the attention of the other members of the board of direction, and action was taken as stated in the report submitted to our membership by the board.

This report is in a sense a colorless document, and advisedly so. The members of the board felt that in submitting such a report, the document should be confined to a statement of facts, and that based upon this presentation of the matter, the members of the society should with an "open mind" decide the question at issue.

Personally, I believe that the proposed change, if carried out, will make for a better recognition of the members of our profession by the public, for a better acquaintanceship with the members of the other engineering societies, for a mutual helpfulness and hearty co-operation in all matters affecting our common profession of engineering. The establishment of a first-class technical library, the possible endowment of which would release funds for additional committee work, is another reason for our going under the same roof with the members of the other engineering societies.

There is no danger that by making this move the American Society of Civil Engineers will lose its individuality. I have before me as I write the plea from an honored member of our society in which the statement is made: "Upon the broad proposition of accepting or rejecting this offer, there should be no question; it should not be accepted. It would be a lowering of the dignity and influence of the American Society of Civil Engineers to go into partnership with any society, however distinguished." It seems to me that the members of the societies with whom we hope to live under the same roof have done as much to establish the dignity of the profession of engineering and to extend its influence as we, the members of the older society.

My plea is for the opportunity of that touch of elbow which makes for brotherhood. CHARLES D. MARX.

Stanford University, Cal.

SIR: The writer here endeavors to answer very briefly the salient arguments of your editorial of March 18, page 377, while at the same time recognizing the value of your opinions when the field of speculation as to the results of the proposed merger has been entered.

It is fully understood by the writer that the chief functions of the United Engineering Society at present are to own and manage the Engineering Societies' Building. That it has other functions seems to be established by the fact that it has issued an invitation to the American Society of Civil Engineers to join in the occupancy and ownership of that building. To that extent, at least, it is the spokesman of the societies connected therewith.

Some of the chief promoters already advocate "enlarging its powers," and some of your correspondents oppose the move "unless it would be possible to merge all of the societies into one American institution of engineers." Another says, "It is certainly a fact, so far as the public is concerned, that the home of the profession is in the Engineering Societies' Building."

So, on the whole, it seems reasonable to suppose that the proposed merger, if carried out, would develop into a single organization embracing the several units, and there are members who favor such union, so why not recognize that probability rather than try to deceive ourselves by ignoring it?

Whether such procedure would or would not be advantageous to the profession, it certainly would eliminate the identity and individuality of the societies entering the merger.

You say that the statement suggesting that the American Society of Civil Engineers would lose its identity, give up its freedom of action, or become subordinate to another organization, "has not the least foundation in fact"; that is merely a matter of your opinion, and that it is entitled to consideration is readily conceded. But the quotations cited herein, and the extent of the control now exercised by the United Engineering Society, with the avowed purpose of "enlarging its powers," show there is some foundation in fact for the statements relating thereto.

If it can be shown that the best interests of the profession at large will be realized by the merger of all of the societies into one organization, that will be the proper thing to do.

The writer's views are not in accord with such a proposition. He believes that the stimulus of a healthy rivalry is necessary to bring out the best there is in the several societies.

You say the Engineering Record accepts in preference the statement in the report of the society's committee, "which expressly says that the operating expenses are practically the same" in the two buildings. The report you quote does say for equal accommodations that the cost of opertaion and maintenance "need not be considered, there being no material difference in the annual cost of operation"; it does not, in the last clause, cover the cost of maintenance at all.

No great stress is laid on the importance of this item, but since the figures given have been questioned by you, attention is invited to the following statements of fact:

The first committee of three appointed to investigate matters relating to the proposed merger, reported to the board of direction of the American Society of Civil Engineers certain figures, including the relative cost of operation, from which it was shown that the cost in the Thirty-ninth Street building would be $2,511 greater than in our present quarters. A minority report of the same committee says there is "a difference of $3,711 in our favor" in our present quarters.

No other figures were developed by the larger committee, and these figures are quoted in explanation of the term "no material difference." Engineers, as a rule, prefer to use actual figures rather than general terms.

You state that the American Society of Civil Engineers is already a member of the "Engineering Foundation," which is organized under the auspices of the United Engineering Society. The invitation extended to us by the United Engineering Society reads as follows: "That out of its desire to welcome the American Society of Civil Engineers into the fraternity of the founder societies, etc., etc., the United Engineering Society hereby . . . . invites the American Society of Civil Engineers to consider entering the United Engineering Society as an additional founder society." Your statement manifestly does not agree with the language of the invitation.

Now as to the library. You say that the answer to the statement that we would lose our property interest in the library is "that it is not true." That is, to say the least, rather a blunt statement to make in a supposedly candid argument, and needs material qualification, as perhaps does also the statement you quote.

In general terms, the present regulations provide "that the present library of each society shall remain the property of that society." That future purchases of books for the joint library shall be made and paid for by the United Engineering Society, and such purchases shall be the property of the United Engineering Society. The existing rules do not, however, prohibit the purchase and ownership of books by the individual societies. Here is further evidence that the functions of the United Engineering Society are not limited to the ownership and management of the building, as you say.

A report to the Board of Direction of the American Society of Civil Engineers gives the results to be expected under existing rules as follows:

"These separate libraries lose their individual values, as they are not kept up to date, and such arrangement results in duplication, expense and loss of efficiency. If a great technical library is to be created, it should be made efficient from the beginning, and there seems to be no reason, under these conditions, why a property right which can never be of value to the owners should be perpetuated."

Whether this view is correct or not, it seems more than probable that it will prevail, and as a consequence the "great technical library" proposed will be owned and controlled by the United Engineering Society.

In the matter of investment in the Engineering Societies' Building, it must be apparent that the American Society of Civil Engineers would simply be a shareholder in a property which could not be sold without the consent of the United Engineering Society, which controls it.

Your assumption that there is a tangible barrier between the civil engineers and the other societies which needs breaking down is hardly warranted by the facts, since many of the engineers belong to more than one society, and there is ample evidence of successful teamwork where very cordial relations existed.

A full discussion of this important subject should obtain. It should be viewed from all angles, with the greatest possible frankness, so that when all the evidence is weighed without prejudice the correct judgment will prevail.

This is the sole object of the writer in entering the field of discussion. In a matter of such importance there will necessarily be a great variety of opinions, and they should be illuminated by the widest possible publicity.

J. A. OCKERSON.

St. Louis, Mo.

[Colonel Ockerson persists in this letter in his erroneous view as to the relation which would exist, should it move its headquarters, between the American Society of Civil Engineers and the United Engineering Society. Moreover, he is confused as to the relation of the United Engineering Society to the Engineering Foundation. Since these are matters of much importance to the profession attention is called to comment on them in the editorial pages of this issue.—EDITOR.]

SIR: You ask my opinion of the advisability of the American Society of Civil Engineers joining the other national engineering societies in the Engineering Societies' Building in New York, and my reasons therefor.

I was one of those who favored such a union when it was originally considered by the American Society of Civil Engineers, and nothing has since occurred to change my mind.

The arguments both for and against this movement are so well and fully stated in the communication recently issued by the board of direction to the membership of the American Society of Civil Engineers that there is not very much left to be said.

Possibly more stress might well have been laid upon the fact that the proposed movement will not in any way affect the identity, independence of action or policy of the American Society of Civil Engineers in its own special field. When the matter was originally considered and voted upon a good many members seemed to have been influenced by the fear that in thus joining with the other societies the American Society of Civil Engineers would to some extent lose or impair its independence of action and suffer in other ways from the connection. It may be said that in all matters other than those where united action is desirable and voluntary the relation of the different societies practically will be little more than that of co-tenants in the same building.

The preparation and publishing of papers, the accumulation of data and adequate professional libraries and the opportunities offered for personal and professional intercourse supply ample justification for the existence and maintenance of these societies. But the time will come, if it has not already arrived, when their numerical strength and financial resources will warrant them in not only extending present, but in entering upon new, fields of usefulness to their membership, the profession at large and the public. What direction these new activities should take is a very interesting question. One field that offers great possibilities of usefulness is that of original research and experimental work.

The generous gift of Mr. Swasey for the establishment of the Engineering Foundation, has supplied a nucleus around which the societies, by united action, might build up a great technical laboratory, not only for original research but for important studies, analyses and tests of materials, and other technical investigations for the membership, at cost, along lines similar to the library searches now conducted by some of the societies. The benefits to both the membership, the profession and the world at large that surely might be counted upon are so obvious that they need not be discussed here.

While neither one of the societies would probably be able alone to develop and support such an institution, it would easily be possible by their united efforts.

S. WHINERY.

New York City.

SIR: The communication of the board of direction of the American Society of Civil Engineers, embodying a proposal of the three engineering societies, constituting the United Engineering Society, to go into partnership in their building erected for them by Andrew Carnegie free of its cost of more than one million dollars, has been received and its contents carefully considered.

It was my hope that this question had been finally settled 12 years ago, when by a vote of the society it was rejected by a majority of about two to one. The same reasons exist to-day against its adoption as then, except those reasons are many times more cogent.

As the only surviving member of what have been designated "charter members" of the society (the members of the first year of its existence), I do respectfully but most earnestly protest against its adoption at this time.

The American Society of Civil Engineers, since the first year of its existence, 1853, has increased from a membership of about 50 to nearly 8000, notwithstanding the 7-year lapse during the Civil War.

Its membership occupy honorable positions in every country of the globe. The last list of membership gives the details with its growth in membership; it has grown much faster in the professional character of its members and in the influence of the society as an organization until, at the present time, it is not surpassed in character and influence by any of similar societies in the world.

"Our society," our board tells, "now has a fine building adequate, in the opinion of many members, for its present needs and, as they think, capable of such enlargement as may be rendered necessary during the next 15 or 20 years."

The money value of all its improvements, consisting of a lot 75 ft. front and 110.7 ft. depth, on which has been erected a four-story building of size to fill the lot—the value of the lot and building is estimated at $475,000, on which there is a mortgage of $50,000. No other debt.

With the income from fees from 7600 membership, which is fast increasing, what more encouraging outlook and future could be asked for our society? Should its increasing membership require more extensive quarters, we can safely trust to the admirable management of our finances by our board of direction as we did 12 years ago, to get us out of our troubles.

All the foregoing has been accomplished without help from any source and with no danger of having the name of a multi-millionaire nailed over our portals.

The proposal from the United Engineering Society is that we shall give up this elegant home on Fifty-seventh Street, and, on certain terms, join with the other three societies (the electrical, the mining and mechanical engineers' societies in the occupancy of the Engineering Societies Building on Thirty-ninth Street, erected for them free of cost by Mr. Andrew Carnegie about ten years since at a cost of $1,050,000. The cost of building and grounds is placed at $1,717,000.

Upon the broad proposition of accepting or rejecting this offer, there should be no question; it should not be accepted. It would be a lowering of the dignity and influence of the American Society of Civil Engineers to go into partnership with any society, however distinguished. With the four engineering societies occupying the proposed building, it would be in the nature of an immense apartment house, with no more privacy. We have elegant headquarters on Fifty-seventh Street, with all the conveniences of such a building. Were we to accept the proposal of the United Engineering Society, it would necessitate the sale of the building, with all its pleasant associations. In these "war times" it would be difficult to sell it at its true value.

Gentlemen of the American Society of Civil Engineers, we have fought the fight and in an existence of about 60 years we have attained a proud eminence among the scientific societies of the world; we have an elegant home on Fifty-seventh Street, New York, sufficient for our needs, and are virtually out of debt. Let us be content and remain where we are.

In conclusion, there does not appear to me any good reason why this change, a momentous one to our society, should occur. Of course, there should be the most cordial co-operation with these three organizations, as they exist to-day. They are all *special* branches of Engineering, but the principles of *civil engineering* lie at the foundation of each of them. But this co-operation can exist just as cordially with the headquarters of each a few blocks distant as if they were "next door."

William D. Pickett,
Hon. M. Am. Soc. C. E.
Lexington, Ky.

Sir: In the issue of the Engineering Record of March 11, comments by different ones are published in connection with the possible moving of the headquarters of the American Society of Civil Engineers to the Engineering Societies' Building.

As a long step forward, the writer is in favor of the change, but is quite in accord with the expressed view of Wm. Barclay Parsons that a complete union of all the engineering societies should be sought, merging into one great national institution. This would not deter specializing, or the investigation of matters of particular interest to different groups. Such a course would inevitably increase the power and prestige of that which is truly a profession.

Louis L. Tribus.
New York City.

Sir: On my return to New York I find your request for my views on the proposed moving of the headquarters of the American Society of Civil Engineers to the Engineering Societies' Building. This seems to me to be a very desirable move.

First, it will tend to improve and extend the good feeling between our society and the other great American engineering societies, and make it easy for them to continue to act in concert, therefore making the influence of all very much greater when the occasion for exercising such influence shall arise.

In this regard it might be stated that in Canada there is only one great engineering organization, which combines the civil, mechanical, mining and electrical engineers. As a result, the Canadian Society of Civil Engineers has a very much greater influence with the government than any of our four national societies can ever hope to attain acting individually—although each of them is in a better financial condition and has a much larger membership than the Canadian society.

In Canada a man is not authorized to practise engineering unless he joins the Canadian society.

The financial consideration should be a minor one, as the American Society of Civil Engineers is by far the strongest—from a financial standpoint—of the four, and can well afford to stay where it is, build a new house, or add two and a half stories to the Engineering Societies Building, as it may prefer.

Combining the libraries will be another great advantage, and the location on Thirty-ninth Street will be more convenient for most New York members as well as all out-of-town members.

As I believe that you would prefer brevity I will close by sincerely hoping that the members of the most powerful society of civil engineers in this country, if not in the world, will add to its own wealth, prosperity and influence, as well as that of the other engineering organizations, by moving into the Engineering Societies' Building.

Of the two plans, A and B, I would much prefer A, but to allow for any new contingency that may arise, I am voting C, knowing that the board of direction can safely be intrusted to use good judgment.

T. Kennard Thomson.
New York City.

Sir: In considering the proposition for the American Society of Civil Engineers to join with the three other large engineering societies in the occupancy of their building on West Thirty-ninth Street, I feel that it would be most undesirable to lose sight of the club-house feature and to deicde the matter by conclusions reached by strictly impersonal reasoning. I feel that the atmosphere upon entering the headquarters of the foremost engineering society of this continent should be essentially human, extending that intangible welcome and hospitality that appeals so keenly to the occasional visitor and makes a pleasant greeting to the regular member, and that that first impression should be maintained throughout the building. The whole scheme of lobby, halls, rooms, furniture, decorations and attendants should be designed with the object of eliminating in every particular the stiffness and formality so noticeable in offices of large corporations where everything is for purely utilitarian purposes and where one feels that he should transact his business and depart without unnecessary delay. It is impossible to soften the angularity of a succession of adjoining rectangular rooms or to relieve the unattractiveness of halls lined with closed doors and terminating in a bank of elevators. It is a fact that the present society house is inadequate in some respects and that changes are desirable, but I believe that, in making any change, the club-house feature should be continued and extended and that the effort should be to foster and promote sociability and companionship in every conceivable way commensurate with the dignity of the association, architecturally, personally and psychologically. I am of the opinion that it would be extremely difficult to bring about such desirable conditions in the building suggested.

Arthur W. Tidd,
Mem. Am. Soc. C. E.
Yonkers, N. Y.

Sir: The first thought of the members of the American Society of Civil Engineers must be one of appreciation of the generous spirit shown by the United Engineering Society in both of its offers. The second thought naturally concerns the desirability of the change. In any such proposal of change, where physical necessity is not involved, inertia is likely to cast the deciding ballot in the negative without regard to the merits of the case, unless the affirmative side is thoroughly developed. This is particularly true in this case where the question is an old one, which was decided in the negative when previously submitted. The ballots having been sent out in advance of discussion will tend to bring out a vote "by return mail" on this basis.

More rapid progress could have been made if those in charge of the matter had broken the news of these offers at the annual meeting of Jan. 19, and the United Engineering Society would doubtless have been pleased to extend to the society, if desired at that time, an invitation to visit the building and become better acquainted with the present and proposed housing arrangements.

It appears to the writer that the general membership of the society is in the position at present of wanting to be shown clearly how and where the society would be accommodated, what the new home would be like, and the advantages to all concerned. The financial statements submitted will be accepted as showing that the move is perfectly feasible from that standpoint and on a very reasonable basis.

The writer is not in favor of the acceptance of offer B, as on the basis of present evidence it would mean the removal of the associated societies now occupying the rooms, who would "have to seek other quarters." Aside from present occupancy, these smaller societies who could not afford a home of their own, appear to have more of a reasonable claim there than the comparatively affluent American Society of Civil Engineers. It would evidently be only a short time before the additional stories would be required and new adjustments be necessary, if this plan were adopted.

On the question of accepting offer A, the writer is of open mind and entertains the hope that the plan will be developed favorably. The general advantage of closer co-operation is evident: have plans for further co-operation been made, and if so, do they show that they can be carried out only after this change? Will it be a disadvantage to have the meetings on the fifth floor and the headquarters ten stories above? Will our space permit a room large enough for a reception or gathering of any kind?

The social aspect is of importance, and much has been said informally concerning the possibility of increasing the attractiveness of the present home of the American Society of Civil Engineers, to provide additional accommodation of this nature. Can this be better accomplished in the proposed change, perhaps by a lounging room or rooms where members could come at any time for conference, where out-of-town members would be welcomed and attracted.

We are proud of our present library and efficient staff; with the very much larger combined library there should be added advantage, if equally accessible for use. In this connection, could not hours be arranged for parts of the building and library, that will permit more efficient use by others than the unemployed, including late evening hours, Sundays and holidays. The combined societies might afford what neither one alone could undertake.

It is to be hoped that the proposed general method of operations, together with other pertinent information, can be furnished for the guidance of the members, in time for definite action in June.

W. E. Belcher.
New York City.

HINTS FOR THE CONTRACTOR

Details Which Save Time and Labor on Construction Work

Other articles in this issue of interest to contractors and construction engineers are indexed in the Table of Contents

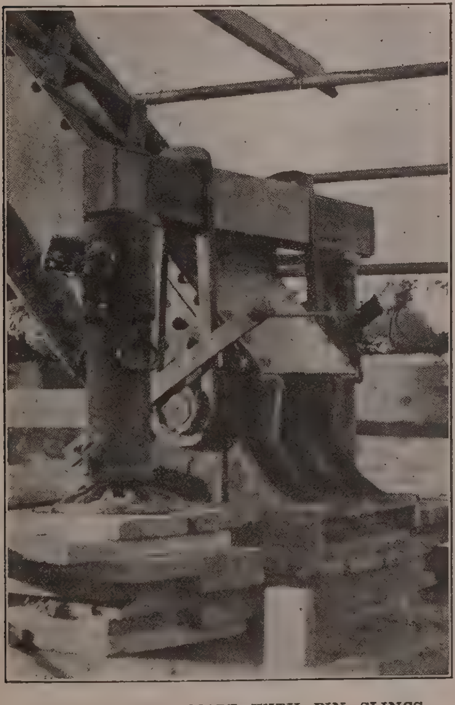
[*Contributions to this section are solicited, and if found available will be paid for. They must be* SHORT, *and should be accompanied, if possible, by photographs or sketches.*—EDITOR.]

Rigid Jacking Hitch Made with Pin Slings for Raising Bridge

By R. C. HARDMAN
Colorado Springs, Colo.

THE JACKING hitch illustrated herewith proved quite steady, though made with slings. It was used in raising a 105-ft. 85-ton, single-span truss bridge over the Arkansas River at the mouth of the Royal Gorge, where falsework could not be built at any reasonable cost and where it was not convenient to arrange for jacking under the bridge seats. The end of the bridge was raised 5 ft. in three lifts of 13, 32 and 15 in. The shoes were raised alternately a few inches at a time and concrete blocks placed under each before the other was lifted. One truss having thus at all times a solid bearing, it was easy to keep the bridge in alignment. The pedestals built up also furnished a good base for the jacks.

These slings were made of 1¼-in. square steel shaped at one end to fit snugly around the hexagonal nuts and at the other end to fit over the top flange of a 6-in. I-beam. Strap iron ties bolted at the ends were used to prevent the slings from slipping off the nuts. Strips of sheet lead were used between nut and sling to secure a uniform bearing, the nuts first having been turned so that one side was at the bottom. The I-beams were filled out flush with the flanges with wood blocks, upon which were nailed small strips on each side of the slings to prevent lateral movement. Under each sling on the flange of the I-beam was a ¾-in. steel plate to distribute the load and prevent crippling of the flange. The jacks were placed as close together as possible in order to reduce the bending moment in the I-beams to the minimum. The roller bearing plates were fastened to the bridge seat, and the jacks were set directly on the abutment for the first lift. Four geared jacks, three 35-ton and one 25-ton were used.



STEADY HITCH MADE WITH PIN SLINGS

The raising occupied 2½ days, but the actual time chargeable to this part of the work was only 10 hr. The labor cost, including the concrete pedestals, was only $15.34.

JACKS TIGHTEN LASHINGS OF 13-TON GIRDER FOR DANGEROUS ASCENT OF MOUNT WILSON

Motor Truck Carries 13-Ton Loads of Steel Up Steep Mountain

THE CARNEGIE Observatory on the summit of Mount Wilson near Pasadena, Cal., was confronted with unique conditions in transporting structural steel members of considerable size and weight required for supporting the new telescope which is under construction. Seven structural steel members of various forms and sizes to be included in the telescope support weighed from 8 to 13 tons apiece. The difficulty arose in the transportation of these members from Pasadena to the summit of the mountain, which is accessible only by a mountain road which is a continuous upgrade for nine miles with many hairpin turns. There was insufficient room at the turns for maneuvering mule teams, and of course the cost of hauling by any kind of winch arrangement would have been great. The difficulty was solved by J. A. Stoner, president of the Mack Motor Truck Company of Los Angeles, who was willing to try out the proposition with one of his 6½-ton Saurer trucks.

Mr. Stoner personally drove the truck seven trips to the summit, each time with one of the large pieces of steel. The two most difficult types of load were the two 13-ton, 28-ft. girders, one of which is shown in the illustration, and a steel drum 10½ ft. across. The difficulty with the girders was that the front wheels on one side were entirely concealed from the driver by the forward end of the girder. To keep within the narrow limits of the highway where it skirted cliffs on one side and canyon precipices on the other he had to depend on wigwag signals from a man riding the front of the girder. The steel drum was so wide that in twenty-five places it hit the bank and either skidded the truck and its load or the load itself.

Maneuvering at the hairpin turns was a risky proposition, as a miscalculation of 4 or 5 in. would have sent the truck over backwards, so near did it have to run to the edges of precipices. The truck carried these successive overloads without damage and was later sold for service in hauling ore in Kingman, Ariz. Two features of its construction which were instrumental in enabling it to carry the excessive overloads without damage are the high efficiency of the cooling system and the design of the motor brake which operates under compression in low gear, permitting safe backing at the short turns, all of which are on inclines. As will be noted from the photograph, jacks and heavy chains were used to bind the structural steel to the truck with sufficient tension in the lashings to make the truck and its load practically a structural unit, thus obviating risk of shifting, which might have had disastrous results at many points en route.

Fire Engines Used to Clear California Waterway

AN UNUSUAL method of dredging a river channel was recently employed to remove silt that had clogged one of the most important slips connecting the river and the ocean at Long Beach, Cal., to such an extent that the traffic was seriously blocked, when a stream from a firehose was brought in play. The fire engines were brought to the scene and a powerful stream of water plowed through the accumulated mud so that a clear passage was made in a short time, which allowed the smaller boats to get to the ocean.

Plans are under way to have this slip immediately cleaned of mud, but as a temporary means of clearing the way, the firehose proved most effective.

Contractors Suggest Schemes for Subaqueous Pipe Line

By ELIOT N. SMITH

Resident Engineer with J. Byers Holbrook, Consulting Engineer for Jersey City

CONTRACTORS who bid upon the Passaic and Hackensack River crossings of Jersey City's proposed new water supply pipe line were invited to submit proposals based upon their own ideas of how the work could best be handled, in addition to the general scheme of construction outlined in the specifications of the Board of Commissioners. Although all of the bids opened Dec. 2, 1915, were rejected, several of the proposals showed careful study of the problem by the contractor and were, apparently, very advantageous to the city.

The Passaic River at the point of crossing is about 500 ft. wide, with a maximum depth of 16 ft. and a hard sand bottom. The Hackensack is about 1000 ft. wide with a maximum depth of 32 ft. and a soft mud bottom. The pipe was to be laid in a dredged trench with a minimum cover of 3 ft. Eleven bids were received and most of them included at least one alternate proposal. The various methods proposed were as follows:

(A) Engineer's Method.—A double line of 48-in. flexible-joint cast-iron pipe was proposed. Joints were similar in design to the modified Ward joint adopted by the Board of Water Supply of New York City for the Narrows siphon. This type of joint depends on a double row of jib screws around the circumference of the bell to force additional lead into the joint and avoid the necessity of calking under water. (See description of this work in the Engineering Record, (Dec. 19, 1914, p. 656). Each line of pipe was to be laid on a foundation of capped pile bents, two bents to each 12-ft. length of pipe. Joints were to be made up on a launching cradle mounted on a scow, down which the pipe was to slide as additional lengths were placed and the scow advanced.

(B) Same as method (A) except that taper spigots were substituted for all but about one-fifth of the flexible joints.

(C) A double line of 48-in. standard bell-and-spigot cast-iron pipe on a pile foundation similar to the foundation described under (A). Most of the contractors proposing this method planned to make up the pipe on deck scows in sections of 2 to 4 lengths, with all joints completely calked. Each section was then to be handled as a unit, without straining the joints, by suspending it at a number of points from a truss or girder. By means of this truss the section was to be picked up and lowered into position on the previously prepared foundation. The next section was then to be made up on deck and lowered to position. The spigot at the end of the new section, according to this scheme, was entered into the bell of the section already placed and the joint calked with lead wool by a diver. Any additional calking necessary to make the pipe line tight was done by divers, and in addition the pipe could be calked internally.

(D) Same as (C). One of the contractors proposed to calk the pipe on shore, bulkhead the ends and launch it. He also proposed to make the foundation for the pipe of piles driven 3 ft. on centers and covered with a 2-ft. bed of concrete placed under water.

(E) Same as (C). Another contractor proposed to assemble and calk the pipe for the entire crossing on the bank of the river, carrying it on wheel trucks running on rails. The pipe would then be launched as one unit by rolling the entire line along a previously constructed track laid on a firm foundation on the bottom of and across the river. Recalking was to be done by divers.

(F) Same as (C), except that the bells and spigots were provided with an interlocking device serving to tie adjacent lengths of pipe securely together. This contractor proposed to substitute, in the Passaic River crossing, supports built up of concrete in bags and laid directly on the bottom of the dredged trench, instead of the pile bents specified.

(G) A double line of 48-in. riveted steel pipe protected with approved pipe coating and encased in several inches of concrete, resting on pile bents as described under (A).

(H) A single line of 72-in. riveted steel pipe; otherwise similar to (G). The procedure under both (G) and (H) was to make up the pipe on launching ways on shore, thread pre-cast, reinforced concrete pipes over the steel pipe as fast as it was riveted up, grout the space between the steel pipe and the enveloping concrete pipes and gradually push the compound pipe out into the river where it was suspended from floats or scows until the entire crossing was completed. It was then lowered to position on its pile foundation, tested, and calked internally if necessary. This is the method followed when the existing 72-in. steel pipe line was laid across the rivers in 1902.

The accompanying table shows approximately the prices for the alternate schemes proposed by the various bidders, compared to the flexible joint method (A), described in the specifications. Roughly, methods (C), (E) and (F) (standard bell-and-spigot) cost from 50 to 80 per cent as much as method (A), and either methods (G) or (H) (48-in. or 72-in. steel pipe encased in concrete) cost from 65 to 75 per cent as much as (A). Of course these bids were based on quotations obtained last November and radical changes have occurred since that time.

New specifications have been prepared based on method (H), involving a 72-in. steel pipe encased in concrete.

PRICE PER FOOT, INCLUDING DREDGING THE TRENCH AND PLACING THE PIPE BUT NOT INCLUDING FOUNDATION

	Method							
Contractor	(A)	(B)	(C)	(D	(E)	(F)	(G)	(H)
1	$77.70	....	$43.52	....	....	....	....	....
2	87.00	....	....	....	....	....	$56.75	$113.50
3	52.00	$36.00	....	....	....	....	....	....
4	....	....	....	$130.00	....	....	....	....
5	71.00	....	....	....	$54.00	....	52.00	99.00
6	56.79	....	30.00	....	....	....	....	....
7	....	....	45.62	....	....	....	....	....
8	78.20	....	....	....	....	$65.18	....	....

50-Foot Cylinder Pier Pulled with Compressed Air

BY DECKING the top of a 4-ft. steel cylinder which went 3½ ft. out of plumb in sinking the foundations for the Lincoln Memorial in Washington, and turning on compressed air at 100 lb. per sq. in., the cylinder was readily withdrawn so that it could be sunk again in a vertical position. The method is described in an article on the Lincoln Memorial by Captain James A. O'Connor, of the Corps of Engineers, U. S. A., in the current issue of *Professional Memoirs*. The ⅜-in. and ½-in.-thick steel shells for these cylinders were sunk by weighting them and using jets, afterward excavating the material inside in the open. Open sheeted pits about 20 ft. deep were dug to start the cylinders in. This one had struck an old pile which deflected it.

In withdrawing the cylinder an air-tight deck of 6-in. timbers was bolted to angles at the top of the cylinder. The cylinder was then allowed to fill with water, and a strain of more than 50 tons was taken on it by means of jacks and chains. The valve in the air line, which was connected just below the deck, was then opened quickly, admitting air to the cylinder at 100 lb. pressure. The object in filling the cylinder with water was to limit the air space, since it takes an appreciable length of time to overcome the inertia of a 50-ft. column of water. Observations on the pressure gage connected with the cylinder showed a pressure of 90 lb. per square inch for several moments after the air valve had been opened. The first twelve attempts raised the cylinder 1 in., the strain on the jacks being taken up each time. On the next trial the cylinder shot up 15 ft., and was then easily removed.

The weight of a complete shell figures about 6 tons, and the uplift on the deck from the compressed air about 80 tons, not allowing for any impact. Allowing for 25 ft. of penetration, this would give the skin friction overcome as a little less than 800 lb. per square foot.

NEWS OF THE WEEK

Passing Events in the Civil Engineering and Contracting Fields

Strike Delays Construction of New York Subway

The claim of a new laborers' and timbermen's union for recognition and a simultaneous demand for an increase in wages, regular weekly payment and strict adherence to the 8-hour law have seriously affected construction work on New York City's new dual subway system. It is believed there would be no objection on the part of the contractors to dealing with the union if it could be demonstrated that the union was a bona fide organization controlling these classes of labor in New York City territory. On this point the views of the contractors and of the organizers differ, the former understanding that the new union is not affiliated with organized labor and the latter claiming that it is.

According to figures published in the *Public Service Record*, on March 1, 12,093 workmen were employed daily, of whom, it is estimated, the classes involved in the strike number 7000. It is said that, altogether, 5000 men had quit work by April 5. The open-cut sections, which depend for progress entirely on the laborers and the timbermen, are most affected, though a number of contractors retained enough men of these classes to continue work. The East River tunnels, where there is no timbering and the muckers belong to the sandhog union, are least affected.

The contractors claim that the prices at which the work was let will not permit them to grant the demands for wage increases. They are now handling the situation as individuals and it is likely that no concerted action on their part will be taken till the matter has developed further. No attempt to employ men to take the places of the strikers has been made, as there are not now enough men in the labor market to make the effort worth while.

Will Start Work on Nave of New York Cathedral

Work on the nave of the Episcopal Cathedral of St. John the Divine, in New York City, which will be the largest church in the United States, will begin May 8. The work is expected to take 5 years and to cost nearly $3,000,000. The transepts, choir and crossing were completed some years ago and were fully described in the Engineering Record.

The cost of the first stage of the new work is estimated to be about $78,000, and it is hoped that contributions will have been plentiful enough by the time the first work is completed to authorize the continuance of the construction. The nave, when completed, will be 260 ft. long, 135 ft. wide and 160 ft. high, with a single large chamber, the interior height of which will be 125 ft.

The cathedral was designed by Cram & Ferguson, architects, of New York, and the contract has been let to Jacobs & Young, also of New York City.

Plan Extensive Work for Hetch Hetchy System in 1916

M. M. O'Shaughnessy, city engineer of San Francisco, in a report recently made on construction work for the Hetch Hetchy system, gives the following as the principal work contemplated in 1916: Construction of the Hetch Hetchy railroad, contract for which was awarded in December, 1915; completion of diversion tunnel and diversion dam; preparation for foundations of the main Hetch Hetchy dam; preparations for construction of temporary power plant to supply power for construction operations at the dam site; exploration borings to determine the character of formations through which the aqueduct tunnel will pass; completion of contract for clearing the reservoir site; continuation of aqueduct tunnel from Early Intake toward South Fork; additional road and trail construction, and the continuation of hydrographic, meteorological and survey work, as well as the protection of the city's water rights.

The aqueduct in the initial development, the report states, will consist of 88 miles of pipe, 5½ ft. in diameter, and 66 miles of tunnels, 10 ft. to 10½ ft. in diameter, a total length of 154 miles to the county line of San Francisco. The tunnels are at present designed for 200,000,000 gal. daily, although it is estimated that the ultimate consumption in the San Francisco Bay region will be 400,000,000 gal. daily from this source. However, it is believed that as the full quantity will not be required for many years, the saving in first cost and interest will greatly exceed the cost of driving a second parallel tunnel when necessary.

Establish Validity of Act Creating Florida Road Department

By a decision overruling a demurrer filed by Leon County against a previous order to pay over to the state treasurer a certain percentage of the automobile license tax for the maintenance of the recently created state road department, Chief Justice Taylor of the Florida Supreme Court removed the last obstacle to the department's proceeding with its work and appointing, in the near future, the road commissioner and assistants authorized in the act.

The state road department was created last year and the five members constituting it were appointed in October, as was noted on page 494 of the Engineering Record of Oct. 16, 1915. To defray its expenses and to pay the salaries of the commissioner and assistants authorized, 15 per cent of the amounts collected as license taxes on automobiles was set aside. Some of the counties, however, refused to pay the required percentage of the taxes collected, on the ground that the act creating the department was not valid.

It is considered likely, in view of the fact that Edward Scott, chairman of the road department, in an address delivered at the recent good roads convention at St. Augustine, stated that the department was only waiting for a decision in the test case to make such an appointment, that the salaried road commissioner will be appointed at the meeting of the board to be held April 12.

Kansas State Agricultural College Holds First Highway Conference

The first conference in Highway engineering ever held at the Kansas State Agricultural College recently took place at Manhattan, Kan. The features of the conference were discussions of problems relating to the location, construction and maintenance of roads. The office of public roads and rural engineering, Washington, D. C., provided an illustrated exhibit of road and bridge models and practical demonstrations in road grading and building were given by the college authorities. One feature of the conference was a large map of Kansas, 6 by 10 ft. showing by means of colored tacks and stars, the roads, bridges, drainage and irrigation projects constructed uider the supervision of the State engineer's office. The conference will be made an annual affair.

Philadelphia Engineers Query Board on Ockerson Letter

Action Taken Because of Fear That Members May Be Influenced by Misconceptions Regarding United Engineering Society

Colonel John A. Ockerson's letter to the local associations of members of the American Society of Civil Engineers was the chief topic for discussion at the meeting of the Philadelphia Association of Members on April 3. As a result of the discussion resolutions were passed asking the board of direction to say, in an official communication to the members, whether certain statements in the Ockerson communication were correct or not. It was feared that these statements, which upon inquiry the Philadelphia association finds have no basis in fact, may influence unfairly votes on the pending measure regarding the removal of the American Society of Civil Engineers to the Engineering Societies' Building. There was also read at the meeting a communication addressed by the secretary of the society, Charles Warren Hunt, to the San Francisco Association of Members, but sent also by Mr. Hunt to the other local associations.

Paragraphs Questioned

The paragraphs in Colonel Ockerson's letter to which the Philadelphia association objects, and regarding which it asks the board of direction of the society to issue an official statement are as follows:

"An invitation has been extended to the American Society of Civil Engineers to enter 'the United Engineering Society as an additional Founder Society.' This invitation itself shows that the destinies of the 'Founder Societies' is largely if not wholly controlled by a superior authority, and the fact must not be overlooked that the relationship which exists between the United Engineering Society and the Founder Society which gives the former authority over them has not been presented in detail to our members.

"Suppose we become an 'additional Founder Society' and desire to put before the public a measure which we have conceived and which we deem important. It must have the sanction of the United Engineering Society, representing a majority of the Founder Societies, which can prevent action, or, if approved, the United Engineering Society would stand before the public as the sponsor of the measure. This illustration applies equally to all the Founder Societies."

(The communication from Colonel Ockerson was discussed by the Engineering Record editorially on March 18, and a letter and a further discussion thereon are found in this issue.)

The chief speaker of the evening was Clemens Hershel, who was chairman of the board of direction's committee which drew up the report to the members on this subject. Following his presentation of the chief features of the plan there was general discussion, participated in by members of the association and by a number of invited guests. Unfortunately for the best presentation of the subject, no one among the membership present nor among the guests was opposed to the plan.

Tunnel Engineers Hold Dinner

The engineers in charge of construction of the eight tunnels being built under the East River for the Public Service Commission of New York City held a dinner at the Hotel Savoy, April 1, at which emphasis was laid upon the necessity for loyalty in the success of a large and hazardous undertaking.

C. M. Holland, tunnel engineer for the Public Service Commission, and his seven resident engineers were present. Commissioner Travis H. Whitney, Alfred Craven, chief engineer, Robert Ridgway, engineer of subway construction, Daniel T. Turner, deputy engineer of subway construction, and George Rice, division engineer, were guests at the affair, as was Major John F. O'Rourke, vice-president and chief engineer for the contractor doing the work.

Call for Conference on Engineering Co-operation

A conference on engineering co-operation to be participated in by all engineering societies and organizations, both national and local, is to be held in Chicago April 13 and 14 in the rooms of the Western Society of Engineers. The following ten subjects are to be considered: Co-operation among engineering organizations—Is it desirable? In what way is it practicable? Benefits of co-operation in securing greater efficiency in the larger matters of concern to the individual engineer, to the profession, and to the public. Methods of co-operation now in practice in various localities; results attained in Philadelphia, St. Louis, St. Paul and other places. Various kinds of engineering societies and committees and the relative efficiency of their operations. Relation of the specialized or exclusive national engineering societies to their local sections or branches and to the more inclusive local engineering society or club. Result of co-operation in securing wider diffusion of knowledge on engineering subjects, as illustrated at Cleveland and elsewhere. The engineering profession as a whole in its present condition as regards public esteem. Reasons for decline in attendance at engineering colleges—Is it indicative of healthful conditions or of proper methods of education? Employment; methods and results as practised by various engineering societies; an exchange of ideas. Legislative activity, proper limits to be set, dangers to be avoided and needs of more systematic and better directed efforts. The committee is headed by Prof. F. H. Newell, University of Illinois, who states that it is the idea to do much of the work both by sub-committees and in general conferences until some consensus of opinion has been reached, at least on some of the fundamentals and to stimulate activity toward the accomplishment of definite results along lines which are now being so broadly discussed.

International Corporation Will Finance Uruguay Work

The American International Corporation has announced that it will finance the waterworks and sewer systems contract in Uruguay on which the Ulen Contracting Company, the contractor, has made preparations to begin work at once, as was noted in this journal on page 431 of the issue of March 25. The work will be paid for by a bond issue, which the International corporation will market.

This step is in accordance with the purpose of the corporation to assist American contractors in foreign fields to finance the works they may undertake, as was indicated in an interview with Willard Straight, its vice-president, which was published on page 93 of the Jan. 15 issue of the Engineering Record.

Chicago to Make Water Survey

The city council has appropriated $17,500 to make a water survey during 1916. That Chicago now uses 254 gal. of water per capita per day is largely due to the leakage and wasteful usage, and engineers of the City Club recently recommended general metering as the only relief from this. However, the $8,960,000 water budget for this year permits no move in that direction.

Committee on Classification of Technical Literature Assigns Subjects

Best Method of Procedure in Making Classification Is Discussed at Meeting in Engineering Societies Building on April 1

A general outline for the proposed classification of technical literature was approved, and definite assignments of the different subjects to the various societies were made at a meeting of the Joint Committee on Classification of Technical Literature held April 1 in the Engineering Societies' Building, New York City. Thirteen delegates from the thirty-two technical societies represented on the committee were present. They discussed the importance and value of the proposed classification, not only for individuals and librarians, but for manufacturing and commercial organizations. Dr. Edgar Marburg, representing the American Society for Testing Materials, emphasized the necessity for adopting the best procedure for ensuring the successful completion of the classification within the near future.

Following the reading of a paper by the secretary, W. P. Cutter, librarian of the United Engineering Society, on "How to Make a Classification," the recommendation of the executive committee to assign different parts of the general outline to suitable organizations from among the various bodies represented was debated. After prolonged discussion on the relative advantages of this method and of the alternative proposed by Mr. Cutter, by which a well-qualified librarian or expert should first work up the complete scheme of classification, a motion to adopt the executive committee's proposal was passed.

List of Assignments

The proposed list of assignments of technical subjects to the various societies was adopted as follows: Aerial transportation to the Aeronautical Society; vessels to the Society of Naval Architect; roads, streets and pavements, American Highway Association; road vehicles, Society of Automobile Engineers; Railroads, American Railway Engineering Association; rolling stock, Master Car Builders' Association; waterways, surveying and structures, American Society of Civil Engineers; materials of construction, American Society for Testing Materials; excavation, geology and mining, American Institute of Mining Engineers; hydraulic and sanitation, American Waterworks Association; electricity, American Institute of Electrical Engineers; water-power, American Society of Mechanical Engineers, and gas to the American Gas Institute.

At the suggestion of the acting president, F. R. Low, representing the American Society of Mechanical Engineers, the presidency of the joint committee was offered to H. W. Peck, of the American Gas Institute, who originated the project in the latter part of 1914. Mr. Peck was unanimously elected.

Chicago Engineers Study Military Preparedness

The Chicago Joint Committee on Military Engineering has arranged a program for one event a week, beginning April 20, when Lieut.-Col. W. V. Judson, will open the series with an address on "The Civilian Engineer and National Defense Organization and Duties." Major P. S. Bond, Cleveland, will give an illustrated lecture on "Service of Reconnaissance and Demolition," April 27, and Col. Mason M. Patrick, Detroit, will talk on "Coast Defense," May 4. By this time outdoor work will be feasible and an exhibition drill in bridge and pontoon building by the engineer company of the Illinois National Guard will be arranged. Capt. Raymond Sheldon, Eighteenth Infantry, U. S. A., will conduct a tactical walk and defense problem May 20. Other events of like nature have been scheduled until July 25, with correspondence courses and practical work to be organized during the summer.

The following officers have been elected: Wharton Clay, chairman; Capt. Robert W. Hunt, vice-chairman; Robert F. Hall, secretary-treasurer. The other directors are: Bion J. Arnold, W. W. DeBerard, J. De N. Macomb, Jr., H. S. Baker, Robert I. Randolph and Vernon C. Ward, Jr.

American Society Members Form Branch in Chicago

The Illinois Association of Members of the American Society of Civil Engineers was formed March 27 in Chicago to further the general welfare of the parent society. Forty-five members attended the meeting in the rooms of the Western Society of Engineers and adopted a constitution proposed by A. S. Baldwin, C. F. Loweth and Albert Reichmann, committee on organization. The annual dues are $2, and no restrictions as to territory are defined. The organization proposes to handle the business affairs only, as heretofore many of the 260 members in Chicago have felt that they were subject to taxation without representation.

There is no thought of having any technical discussions at quarterly meetings. It is intended that the new association shall work in perfect harmony with the Western Society of Engineers in this respect.

The officers elected are as follows: President, Onward Bates; vice-presidents, C. F. Loweth and A. N. Talbot; secretary-treasurer, E. N. Layfield.

Causeway at Sacramento Opened

The opening of the $393,000 Yolo concrete causeway was recently celebrated in an informal manner when approximately 2500 automobiles and 8000 people crossed the roadway on the first day it was put in service. The structure, which was described on page 248 of the Aug. 28, 1915, issue of Engineering Record, is 16,310 ft. long and connects the east and west sides of the Sacramento Valley, which are separated by the waters of the Yolo basin. The Governor of California is expected to officiate at the formal celebration of the completion of the causeway to be held May 12.

Paint Trailers En Route to Speed Delivery to U. S. Army

A unique and rapid shipment of equipment for the United States troops in Mexico, was recently made by the Troy Wagon Works Company, of Troy, Ohio. Twelve trailers, made by that company for use with Jeffrey Quads, were shipped on a special train at 5.00 p. m. March 24 and arrived at El Paso, Tex., March 28.

Owing to the necessity for speedy delivery, the fact that the trailers were not yet painted was not allowed to delay the shipment. Painters were put on the train and completed the finishing touches en route.

$70,000 Voted to Deepen Channel of East River, New York

The House of Representatives, at the April 4 session, voted an initial appropriation of $200,000, with authorization of continuing contracts for $500,000 for a 35-ft. channel in the East River, from deep water in the New York harbor to the navy yard. This was the only new item in the Rivers and Harbor Bill, and was recommended by the President.

Road Work in Washington

In the March 4 issue of the Engineering Record an article was headed "Oregon County to spend $750,000 on roads during year." The work is to be done in Snohomish County, Wash. A. B. Dean is chief deputy of the county.

President May Authorize Investigation of Power Sites for Nitrogen Plants

Amendment Authorizing $15,000,000 Appropriation and Setting Aside Five Water Power Sites Expected to Cause Big Discussion

What is expected to be one of the biggest debates in the Senate in some time is scheduled to come up during the discussion of the Army bill. The fight will center around Senator Smith's (of South Carolina) amendment for a $15,000,000 appropriation and authorizing the President to set aside not less than five water power sites, upon which it is proposed that the government erect plants to manufacture nitrate. The bill is practically the same one that was killed in the House, but Senator Smith claims that he has sufficient backing to put it through the Senate as an amendment to the Army bill.

The Army bill is now passing through the volunteer army stages and the power plant amendment in all probability will follow the finishing of that item.

Senator Smith's bill, besides providing for the $15,000,000 appropriation and the authorization of the President to set aside at least five sites for power plants, provides for an investigation by experts as to the best methods of using the water power of the country in developing nitrate plants.

That the Smith plan has the support of Senator Underwood is evidenced by his stand and his charges that the du Pont Powder Company had attempted to defeat legislation for a government plant. Last Tuesday he again attacked the du Pont Company after reading a letter from Pierre S. du Pont, president of the company, saying his concern had not sought to defeat the Muscle Shoals nitrogen plant.

American Society Move Develops No Opposition

With the exception of one written communication, no opposition to the proposed move of the American Society of Civil Engineers from its present house to the Engineering Societies Building on Thirty-ninth Street developed at the regular meeting Wednesday night. When the subject was discussed at a previous gathering of the civil engineers there was criticism to the effect that the opposition was not given an opportunity of stating its side of the case. At this week's meeting, therefore, a particular effort was made by the presiding officer, George S. Tuttle, to induce the opponents of the change to express their opinions. There was no response to his words.

President Elmer L. Corthill spoke in favor of transferring the society headquarters to the Thirty-ninth Street building, and his views were reinforced by brief addresses from Prof. William H. Burr and Clemens Herschel. Secretary Charles Warren Hunt answered a number of questions dealing with the financial and library features of the proposal.

San Diego to Build Dam and Reservoir

The city of San Diego, Cal., gained an important victory in its efforts to carry out a proposed water development project, roughly estimated to cost $2,000,000, when a decision was rendered by the United States land office at Los Angeles, granting permission to the municipality to appropriate waters of San Diego River and to use a site near El Capitan for constructing a reservoir. Construction of a dam 160 ft. high, to divert approximately 22,000,000 gallons of water a day, and an aqueduct and pipe line, about nine miles long leading into the University Heights reservoir is contemplated.

News of Engineering Societies

The National Fire Protection Association will hold its annual meeting May 9 to 11, in the Insurance Exchange, Chicago.

The Engineers Club of Seattle recently heard Dr. M. A. Mathews give an informal discussion of "Engineers I Have Met."

The Engineers Club of St. Paul held a meeting April 5, at which W. E. McCourt, professor of Geology at Washington University, discussed engineering geology.

The Engineers Club of Philadelphia has arranged for a lecture on the evolution of the automobile to be given by Howard E. Coffin, chief engineer of the Hudson Motor Car Company, April 18.

The Pacific Northwest Society of Engineers, of Seattle, Wash., listened to William T. Roberts, chief engineer of the Inter-County River Improvement Commission, tell of some of the problems in the flood control of the White, Stuck and Puyallup rivers, at the meeting April 1.

Personal Notes

SIMON BRUNER, one of the partners of the Roche Bruner Building Company of Cincinnati, has retired from active participation in the business. His son, Mark Bruner, will continue in the firm with M. J. Roche. During the ten years of partnership the company has built some of the largest structures in and around Cincinnati. Its most noted work is the newly completed office building for the Western & Southern Life Insurance Company.

GUY PINNER has been appointed bridge engineer of the Seaboard Air Line, effective April 1.

W. O. SCHEUERMAN resigned from his position as assistant bridge engineer of the Seaboard Air Line April 1.

J. E. KISSEL is now acting engineer, maintenance of way, for the Peoria & Eastern Railway.

B. M. CHENEY, who has served as acting general inspector for the Chicago, Burlington & Quincy for the past year, has been made general inspector of permanent way and structures for that road, with headquarters at Chicago. Mr. Cheney began his engineering career as a rodman for the Burlington, Cedar Rapids & Northern Railway in 1900. In 1902 he became resident engineer for the Des Moines, Iowa Falls & Northern Railway. In 1903 he went to the Illinois Central, and in 1904 was made assistant chief engineer on construction for the Inter-Urban Railway, with headquarters at Des Moines, Iowa. He accepted an offer from the Burlington in 1906 and for the following four years was assistant engineer on construction and maintenance of the Beardstown division. Mr. Cheney was promoted to the position of assistant to the general inspector of permanent way and structures in 1914 and in 1915 was acting general inspector.

R. T. SAILMAN, until recently division engineer on the Winnipeg Aqueduct, has resigned from his position to join the "American Legion, 212 Battalion, C. E. F., which is being organized at Winnipeg, Canada.

Ernest P. Goodrich has announced that he will resign from his position as consulting engineer for the Borough of Manhattan, N. Y., to take up new duties. Mr. Goodrich has been active in the improvement work for the west side of New York City and now that the detailed report is completed he will devote his attention to city planning and work affecting state and federal organization. He was, for four years, chief engineer for the Bush Terminal Company, and has also acted in an advisory capacity for several cities.

A. M. TURNER, formerly acting engineer, maintenance of way, for the Peoria & Eastern Railway, has been appointed district engineer for the Cleveland, Cincinnati & St. Louis, with headquarters at Columbus, Ohio. Mr. Turner will have charge of track-elevation work.

STONE & WEBSTER ENGINEERING CORPORATION has removed its New York office to 120 Broadway.

HERSCHEL O. HALBERT has left his position as assistant road engineer for Baltimore County, Md., to become associated with George W. Drury, bridge contractor, of York, Pa.

SAMUEL A. GREEN has been appointed assistant road engineer for Baltimore County, Md., succeeding Mr. Halbert, whose resignation is mentioned in this issue.

HIRAM N. SAVAGE has resigned from his position as supervising engineer for the U. S. Reclamation Service to become consulting engineer for the Sweetwater Water Company of San Diego, Cal., in which capacity he will direct the work to be done on the Sweetwater storage and distribution system.

J. B. MORLIDGE has left the employ of the city of Newport, Ky., after 12 years of service, to engage in the general practice of engineering, specializing in pavements, highways and sewerage. Mr. Morlidge's office will be in the Mitchell Building, Cincinnati, Ohio.

J. C. TRAVILLA has been engaged to act as consulting engineer on the road work to be done in St. Louis County, Mo.

S. A. COBB has been appointed highway engineer for Clackamas County, Ore.

T. A. ROOTS is now supervisor in the highway department of Clackamas County, Ore.

C. S. WHITNEY is now employed as assistant engineer for John Parkinson, architect, of Los Angeles, who has charge of the design for the new Los Angeles Union Terminal buildings. Previous to his present connection Mr. Whitney was associated with the Stone & Webster Engineering Corporation and Gustav Lindenthal, of New York City.

VICTOR A. AUFFANT has left his position with the Department of the Interior of Porto Rico to become municipal engineer of Ponce, Porto Rico.

LAKESIDE DREDGING COMPANY of Detroit, Mich., has moved its office to the Penobscot Building.

HARRISON ENGINEERING & CONSTRUCTION CORPORATION is the new name of the Harry B. Harrison Company of Buffalo. The new name gives a better idea of the nature of the firm's business, which consists of paving, sewer, sewage-disposal and reinforced-concrete construction work.

C. MCCREA has resigned from the U. S. Reclamation Service to become associated with B. C. Lillis, consulting engineer, of Billings, Mont.

ARTHUR FALKENAU, vice-president of the Hooper-Falkenau Engineering Company of New York City, has become acting consulting engineer for the Canadian Car & Foundry Agency.

C. N. HARRUB, formerly with the New York Continental Jewell Filtration Company, of New York, has accepted a position as sanitary engineer for the United States Public Health Service.

C. W. WALLS has left the state highway commission at Salem, Ore., to enter the mercantile business.

PARKENHAM W. BEATTY is now chief engineer for the Buenos Aires Underground Railway, which is a part of the holdings of the Anglo Argentine Tramway Company, of Buenos Aires.

R. T. Wells has resigned from his position as city engineer, of Parsons, Kan., to engage in the engineering business in Bartlesville, Okla.

James H. Johnston has resigned from the position of superintendent of streets and sewers for Newburyport, Mass., to accept a similar position at Leominster. In addition to the supervision of streets and sewers, Mr. Johnston will have charge of the Leominster parks.

Richard W. Rea, civil and hydraulic engineer, of Portland, Ore., has resigned from the position of chief engineer of the Coast Culvert & Flume Company, of that city, to open an office in the Spalding Building. He will specialize in the investigation, design and construction of municipal water supply, irrigation and drainage works. During the year 1912 Mr. Rea was assistant engineer on the final location and design of the $5,000,000 Kittitas "Highline" canal project, and during 1913, 1914 and part of 1915 he was chief engineer for the Cascade Irrigation District, at Ellensburg, Wash. On this last work he re-designed and rebuilt the entire main canal system, the work done including over ½ mile of tunnels and five miles of 150 second-foot capacity, semi-circular, metal flume, besides the enlargement of approximately 35 miles of earth canal. On March 21 he was appointed project engineer for the Ochoco Irrigation District, at Prineville, Ore., and will put parties in the field about April 10 for the purpose of making final surveys and plans for construction of the canal system. The project comprises approximately 18,000 acres of settled lands adjacent to the city of Prineville, and the estimated cost is about $800,000. The work as now projected includes, as the principal item of expense, an earth fill dam 130 ft. high, to store 40,000 acre-feet of the flood waters of Ochoco Creek. Mr. Rea's headquarters on this work will be Prineville, Ore.

E. E. Terrell has been elected county surveyor for Hennepin County, Minn. Mr. Terrell is a graduate of the University of Wisconsin and has been in the county surveyor's office at Minneapolis for the past nine years.

Frank Lotz has been appointed city engineer of Vader, Wash.

A. R. Cullamore has resigned from his position in the engineering department of Toledo University to accept the position of dean of the engineering department of Delaware College.

Frederick H. Robinson, who has just retired as head of the civil engineering department of Delaware College, will be the first beneficiary of a $25,000 pension fund given the college recently.

F. H. Shaw, consulting engineer, of Lancaster, Pa., has opened a New York office in the Woolworth Building, where he is prepared to take charge of the design and construction of engineering work, including water, gas, sewerage, railway and hydro-electric installations.

Elmer A. Porter has resigned from his position as district engineer for the U. S. Geological Survey to accept a position as engineer in charge of water distribution on the lower Sevier River, with headquarters at Delta, Utah. Mr. Porter has been connected with the U. S. Geological Survey in Alaska and took part in the Twin Falls project in Idaho and U. S. Reclamation work in the state of Nevada.

A. R. McGinness has been promoted to the position of superintendent of construction for the U. S. Reclamation Service, with headquarters at Ballantine, Mont. He is a graduate of the engineering department of the Colorado Agricultural College and has been connected with the Government since 1912, previous to which he was engaged in railroad and municipal engineering work in this country.

Olmsted and Gillelen, consulting engineers, of Los Angeles, have been retained by the city of Fresno, Cal., to make a survey of that city to determine the feasibility of the proposed sanitary and storm-sewer system. The success of a bond issue of $500,000 for the construction of the sewer system depends upon the favorable report of these engineers.

Ralph L. Rizer has been appointed city engineer of Cumberland, Md., to succeed James P. Gaffney, retired. Mr. Rizer's promotion comes after ten years of service in the city engineering department of Baltimore, most of which time was spent as assistant city engineer.

I. Kvitrud has been promoted from the position of engineer and assistant estimator for Splady, Albee & Smith, general contractors, of Minneapolis, to the position of assistant superintendent, with headquarters at Sioux City, Iowa.

C. W. Obert, who has been associated with the American Society of Mechanical Engineers for the past three years in the capacity of associate editor of the Journal of the Society, has accepted the invitation by the council of the American Society of Heating and Ventilating Engineers to become secretary of that organization. Mr. Obert has already assumed his new duties, with headquarters in the Engineering Societies Building, New York City. He was associated with the Boiler Code Committee when that body was preparing the report for publication in its final form and was made a member and secretary of that committee February, 1915. Mr. Obert was also connected with the editorial staff of the Engineering Record at the time when its pages were devoted largely to heating and ventilating subjects.

Obituary Notes

William E. Hoyt, consulting engineer for the New York Central Lines, died at Rochester, N. Y., April 2, at the age of 71. Mr. Hoyt was graduated from the Massachusetts Institute of Technology in 1868 and entered railway engineering service that year. After holding several positions in the engineering departments of various roads, he became assistant engineer for the New York Central in 1900 and in 1907 was made special engineer for that railroad, which position he held until his death.

Civil Service Examinations

United States: The Civil Service Commission announces an open competitive examination May 9, 1916, for valuation analyst in the division of valuation, Interstate Commerce Commission. The salaries in the first grade range from $3,600 to $5,000 and in the second grade from $1,800 to $3,300. Appointments to these positions will be principally for duty in Washington, D. C., but some appointments may be made for duty in the field. The duties of this position will be to compile data and to prepare complete, concise and logical reports upon valuation subjects, and to analyze, edit, and digest reports submitted by sections of the division of valuation. Competitors will not be assembled for examination, but will be rated on the following subjects, which will have the relative weights indicated.

1. Education	30 points
2. Experience	30 "
3. Reports and writings submitted	40 "

Applicants should have had actual experience in the final preparation of financial, statistical, or valuation reports upon public utilities, and possess the ability to prepare such reports in a concise, clear and logical form. Applicants for positions under grade 1 must show that they have had at least 18 months' responsible experience in the final preparation of financial, statistical, or valuation reports upon public utilities and must be between 30 and 60 years of age. For grade 2 positions, such experience for at least six months must be shown and the age limit is between 25 and 50 years. In each case this experience should have been gained in the employment of a public authority or commission engaged in the effectual regulation of public utilities, or with an important public utility, or in investigations of a similar character. Experience with mercantile concerns, with large utilities in routine positions, or with small utilities with limited operations will not be accepted as qualifying experience in this connection.

An open competitive examination for associate engineer-physicist will be held May 2 in the Bureau of Standards, Department of Commerce, Washington, D. C., or Pittsburgh, Pa. Salaries range from $2,000 to $3,000 a year. The duties of this position will be to investigate structural and engineering materials. It is desired to secure eligibles who are proficient in mathematics and its application to physical and engineering problems, and who are fully able to initiate and carry on independent research in the field of engineering. They should have experience in the investigation of engineering and structural materials, the operation and calibration of testing machines, and the interpretation of the results of investigations. Applicants must be between 30 and 45 years of age.

Forms for any one of the above examinations may be secured from the U. S. Civil Service Commission, Washington, D. C., or at any of the civil service boards in the cities where examinations may be taken. In applying for forms for the examination for valuation analyst, form 2039 should be requested and form 2118 is to be filled in by those desiring to take the engineer-physicist examination.

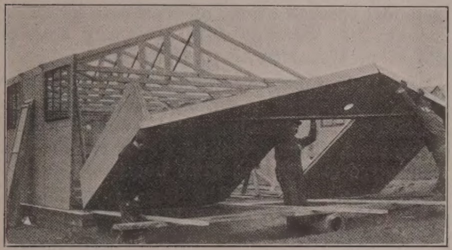
State of New York. Examinations for junior electrical engineer, Public Service Commission, will be held May 6. Salary $901 to $1,200. Candidates must have had at least three years' training in a technical school of recognized standing and not less than one year's experience in electric railroad or electric lighting work or in the manufacturing or installation of electrical or mechanical apparatus. Details may be obtained from the State Civil Service Commission, Albany, N. Y.

Examinations Previously Announced

Date		See Eng. Record
April 3-8	Architectural draftsmen, salaries from $900 to $1,200 and from $1,200 to $1,500 respectively; rodman, salary from $840 to $960 a year, and assistant engineers, salaries $2,100 to $2,500 a year, Philadelphia	March 4
April 12-13	Computor and Estimator, salary $1,600 a year	April 1
April 17-20	Draftsmen, Highway Bureau, City Transit Department, Bridge Division, Philadelphia	March 11
April 18	Engineer economist, salary from $2,000 to $2,500	April 1
April 19	Junior signal engineers, salaries from $1,200 to $1,680, and junior structural engineers, salary $720 to $1,080	April 1
April 26	Tracer, salary $600, Philadelphia	April 1
May 3	Transitman, salary $1,200 to $1,500, Philadelphia	April 1
May 4-5	Assistant engineer, salary $2,500, and structural draftsmen, salary $1,200 to $1,500, Philadelphia	April 1
Aug. 21-25	Second lieutenant of civilian candidates	April 1

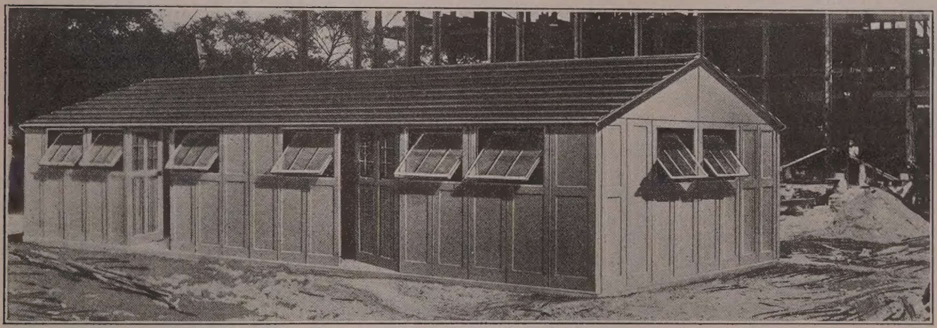
Portable Small Steel Buildings

Consisting essentially of various pressed steel panels and structural steel units fastened together by slotted keys, and locking wedges with an ordinary hammer, portable steel buildings which are claimed to be durable, economical and easily built in place are now available for use as contractors' temporary offices on the job, tool houses, time-keeper's offices, and as railroad section houses, switchmen's houses and bunk houses for construction gangs. In a 32-page booklet issued by the Trussed Concrete Steel Company, of Youngstown, Ohio, entitled "Kahn Portable Steel Buildings," the details of the construction, with many illustrations and examples of applications, will be found fully explained.



RAISING END OF SMALL BUILDING

Price lists together with special order blanks will be furnished by the company on request.



PORTABLE CONTRACTOR'S HOUSE IS OF ATTRACTIVE APPEARANCE

By making the various panels of standard size and interchangeable, buildings of any size or arrangement of wall space, windows and doors can be erected. The solid wall panels of heavy gage steel are formed by large dies operated by powerful presses, with simple panelling which adds to the appearance. Light and ventilation are provided by glazed panels of steel sash welded into the standard wall panel, with pivoting and adjusting devices. Roofs are built up of special rolled steel roofing plates designed and keyed to ensure watertightness, with an air-tight interlocking connection, and supported by standard unit trusses, complete in themselves and electrically welded at the joints. As seen in one of the accompanying photographs, no bolting or riveting of any kind is used, and the trusses are braced to insure rigidity.

Advantages

Among the advantages claimed for these buildings, which are essentially distinguished by their portability and ease and rapidity of erection, are the following: Fireproof qualities, which are particularly valuable in garages; durability—the application of a coat of paint every four or five years should ensure practical permanence; simplicity in erection by the use of the slotted keys and locking wedges driven by a hammer, all sections being easily handled by two men, who can erect any building complete; flexibility, ensured by the use of standard unit panels which can be added at any time if increase in size is desired, and weather-proof qualities, provided by special weather stops in joints between the panels and between the roof plates.

New Cement Plant Opens

The Duluth plant of the Universal Portland Cement Company, known as Mill 7, It has a daily capacity of 4000 barrels. As in the case of other Universal mills, blast furnace slag and limestone are used in making the cement. The plant adjoins that of the Minnesota Steel Company from which the slag is secured. The limestone comes from Calcite, Mich. The mill is operated by power furnished by the Great Northern Power Company from its hydroelectric plant at Thompson, Minn., on the St. Louis River, 15 miles distant. A power of 4000 kw. at 66,000 volts comes into the plant over a transmission line. The power company has a transformer station at the plant where the voltage is stepped down to 2200. The Universal Portland Cement Company has its own transforming station which steps about half of the current down to 220 volts, the other half being used direct at the 2200 voltage.

The plant is built of concrete and steel, the 17 buildings being constructed of reinforced-concrete, or of steel frames with curtain walls of concrete blocks. The floors and roofs are also of concrete. The storage tanks, 27 in number, are of circular concrete design. The plant employs between 300 and 400 men, for whose accommodation an industrial town has been constructed near the plant. The town is called Morgan Park, and will house the employees of the Minnesota Steel Company as well. All the houses, streets, alleys, curbs, and sidewalks in this town are of concrete construction. There are approximately 450 residence buildings, including apartment houses and single dwellings.

This plant is designed to furnish prompt service for the rapidly increasing demand for cement in the Northwest. This section has hitherto been supplied from mills in Iowa, Illinois, Indiana and Michigan.

Mixer Company Reorganizes

The Ransome Concrete Machinery Company, of Dunellen, N. J., has been reorganized and will begin the enlargement and improvement of its plant immediately. E. L. Ransome, who has been connected with the company since its establishment in 1892, will continue his work as chairman of the board of directors and consulting engineer, and J. J. Givens will continue as treasurer.

Frank L. Brown, of San Francisco, is the new president and manager, and comes to his position after years of varied experience in engineering work on the Pacific Coast. The other officers and directors of the new organization are: G. F. Stiele, general manager of the News Print Manufacturing Association, and connected with the National Harvester Company of Chicago; Howard K. Brooks, vice-president of the American Express Company; F. M. Smith, who owns large interests in California railways, and H. M. Brittan, for many years associated with the Washburn-Moen Manufacturing Company, of Worcester, Mass.

The new organization has opened executive offices at 115 Broadway, New York City.

Motor Tractor with Power Winch Can Be Put to Varied Uses

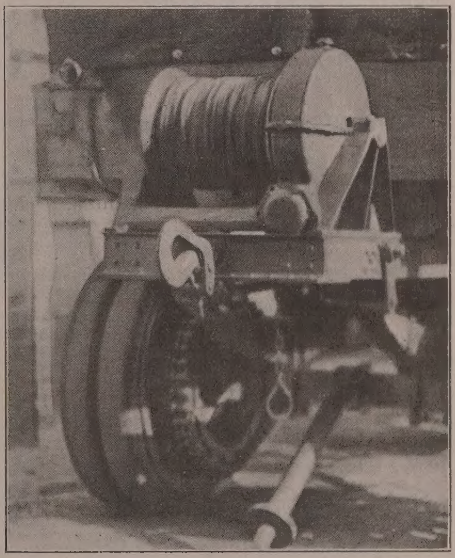
The special feature of the new Model 36 motor tractor of the Knox Motors Associates, of Springfield, Mass., is a powerful winch, attached to the rear of the tractor frame, and driven from a power attachment on the transmission. A heavy sprag attached to the rear axle makes it possible to anchor the tractor quickly previous to making use of the winch.

The truck can tow in either direction. At the rear of the tractor frame a large steel hook is attached and a heavy buffer spring is inserted to absorb the shock of sudden starting. An automatic locking device prevents the escape of the chain or ring which may be inserted for towing. Two front hooks of the twisted type are attached for use in cases where it is desirable to tow backward or to anchor the tractor in addition to the sprag.

The chassis is designed to support a weight of from 2 to 4 tons in any form of body which may be desired, thus insuring the necessary degree of traction, and enabling the tractor to act as a carrying as well as a hauling vehicle. Steel wheels are provided at small additional cost, either as a substitute for the standard rubber-tired wheels or as extra equipment, thus insuring the successful operation of the tractor even under unusually unfavorable road conditions.

The winch is equipped with 150 ft. of cable and is driven from a power attachment on the transmission through a propeller shaft and two universal joints to a worm and gear on the winch shaft. The winch drum is loose on the shaft and is driven through a clutch which may be released by hand when it is desired to reel off the cable. With the motor running at 1000 r.p.m. the cable is hauled 40 ft. per minute.

The tractor is claimed to be a practically unbreakable, trouble-proof hauling vehicle, especially adapted to heavy work and unusually severe road conditions. For example, where it is called upon to haul a heavily loaded four-wheeled trailer, or a train of trailers, up an abnormal grade, the trailer wheels can be blocked, allowing the tractor to run ahead of the load a distance equal to the length of the winch cable. It can then be anchored by means of the sprag and the 20,000-lb. draw-bar pull exerted by the motor through the winch utilized to bring the loaded trailer or trailers to a position directly in back of the tractor. In bad going, the winch may also be used to pull the tractor or trailer up on to solid ground when either has become mired.

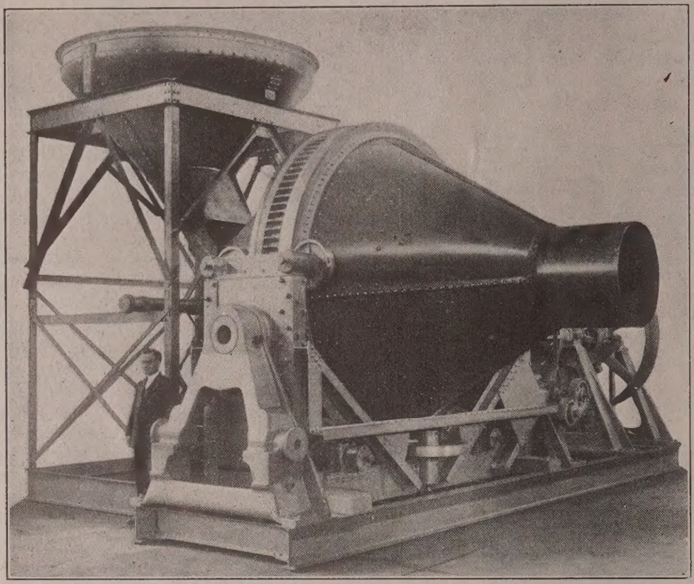


SPRAG ANCHORS TRACTOR SECURELY

The winch feature also equips the tractor to perform a number of useful tasks in connection with the transporting of heavy tonnage. In the lumber field, for example, the winch can be used to pull heavy logs or timbers into place preparatory to loading, etc. Contractors can use the winch for wrecking buildings and for hoisting heavy materials.

Immense Tilting Mixers Made for Use at Salisbury, N. C.

The largest concrete mixers ever manufactured have just been completed for the Hardaway Contracting Company, of Washington, D. C., to be used in pouring 60,000 cu. yd. of concrete a month until the dam at Salisbury, N. C., is finished. They were built by the T. L. Smith Company, Milwaukee. The two tilting mixers, each having a capacity of 108 cu. ft. of mixed concrete per batch, are twice the capacity of any used on the Panama Canal.



ONE OF THE NEW GIANT MIXERS, HAVING A CAPACITY OF 108 CU. FT. OF MIXED CONCRETE PER BATCH, BUILT FOR USE AT SALISBURY, N. C.

Each machine is mounted on steel skids and weighs 46,000 lb. The hopper is supported by the steel frame and the mixer itself is equipped with a power tilt and an Allis-Chalmers clutch pulley. The mixer drums are made of ⅜-in. steel and the inside diameter of the drum is 9½ ft.

Combined Transit and Level Has No Extra Parts

An improved convertible or tilting level, which has no loose parts not in use when in either position, has recently been placed on the market. The crossbar and standard for holding the telescope when in transit position are cast in one piece. The center of the bar is cut away to permit the telescope to be placed in the standard with the level below in active position. This also gives room to raise or lower the telescope 45 deg. above or below the horizontal. The instrument can be converted, it is claimed, into the modified form in 10 seconds. It is made by the David White Company, Milwaukee, Wis.

New Expansion Joint Material for Roads Easily Handled

A new expansion joint material for concrete, brick and black pavements, that needs only to be unrolled, cut and laid in place, has been put on the market in the Barrett Company, 17 Battery Place, New York City, under the trade name of "Barrett's Expansion Joint."

It is a mastic, which comes in ribbon form, in a variety of widths and thicknesses, ready to lay. It contains no felt or paper reinforcement. A new method, known as the "Fibre Weld" process, gives to the bituminous mastic the requisite cohesiveness to stand handling and storage in the ribbon form, without affecting the elasticity that is necessary for expansion requirements. It possesses, it is stated, all the elasticity of a poured bituminous joint with all the advantages of easy handling.

It is claimed that the material is not injured by street acids or automobile oils. It does not become brittle with age or cold weather and does not soften or run in hot weather.

Its chief advantage over the usual poured bituminous joint is the elimination of heating or pouring apparatus, and a great reduction of the labor item, as it takes only a moment to unroll the joint and cut and put it in place.

Construction Companies Merge

The McClintic-Marshall Company, of Pittsburgh, manufacturer and erector of steel buildings and bridges, has purchased the plant and business of the Riter-Conley Manufacturing Company of that city at a price reported as $3,250,000.

It is said that the Riter-Conley plant will be operated independently under its present name. It is expected that J. Gilmore Fletcher, who has been president of the company, will resign to look after other interests.

Business Notes

Parker Supply Company, manufacturers of expansion bolts, screw anchors and sheet-metal-workers' specialties, has moved to 785 East 135th Street, New York City.

C. W. Levalley, president and general manager of the Chain Belt Company, of Milwaukee, has been made chairman of the board of directors. He founded the company 25 years ago to make detachable chain belt for farm implements. The company gradually got into the elevating and conveying machinery business and nine years ago entered the concrete mixer field. W. C. Frye, who has been with the company for 20 years, succeeds Mr. Levalley as president, and also retains his present position as treasurer. He is also treasurer of the Sivyer Steel Casting Company, vice-president of the Federal Malleable Company and a director of the new Electric Steel Company, of Chicago.

The Canton Culvert and Silo Company, of Canton, Ohio, has won its appeal in the Court of Appeals in the District of Columbia against the Consolidated Car Heating Company. The latter organization had applied for a trade mark, substantially identical with the No-co-ro mark registered by the Canton company, and covering high-corrosion-resisting metal. The court declared that "appellant was the first to adopt this mark and has established a trade reputation in connection therewith. There was no legitimate reason or excuse for its adoption by appellee (The Consolidated Car Heating Company) upon this line of goods and we are not disposed to indulge in refinement where such a manifest appropriation appears."

Trade Publications

The following companies have recently issued trade literature:

J. I. Case Threshing Machine Company, Racine, Wis., catalog, 9 x 12 in; 32 pages. Case road building machinery.

Builders Iron Foundry, Providence, R. I., Bulletin 86, 6 x 9 in.; 51 pages. Presents the principle and advantages of the Venturi gas and air meter.

Joseph Dixon Crucible Company, Jersey City, N. J., booklet, 3¼ x 6¼ in., 20 pages. Dixon's waterproof graphite grease for pumps, elevators, exposed gears and machinery, dredging machinery, etc.

Ludowici-Celadon Company, Chicago, catalog, 9½ x 13½ in; 105 pages. An illustrated technical presentation of various forms of roofing tile, together with necessary data on tile roofing construction.

Link-Belt Company, Chicago, book 213, 80 pages, Link-Belt elevators, conveyors and machinery for handling and storing gravel, stone, sand, cement, etc., in which are included locomotive cranes and grab buckets.

American Rolling Mill Company, Middletown, Ohio, booklet, 6 x 9 in; 38 pages. Describes methods of using "Armco" iron flumes, Lennon type, and contains tables for computing carrying capacity, freeboard, etc., of these flumes.

Unit Construction Company, St. Louis. Catalog, 8 x 11 in., 13 pages, illustrated. The first eight pages are blueprint plans of "Unit Bilt" concrete trainsheds, roundhouses and car barns for various railroads. The remaining pages are photographs of similar structures completed or in process of construction.

Ingersoll-Rand Company, 11 Broadway, New York City, booklet 9201, 6 x 9 in., 128 pages, illustrated. The core drill, its functions and field of adaptability in connection with contracting, stone quarrying and mining are discussed in this catalog. The Calyx core drill and outfit is described in relation to these respective fields, and its peculiar advantages indicated. Among these is its great range in drilling capacities from 250 ft. in the small size to 4000 ft. in the largest.

T. L. Smith Company, 3104-X Hadley Street, Milwaukee.—Folder covering the Smith Mixerette, the smallest of the Smith line. This machine has a capacity of 3 cu. ft. of mixed concrete per batch, or approximately 5 cu. yd. of mixed concrete per hour. The folder illustrates all the possible combinations of this machine—with different kinds of power, with a hoist attached, and with a loading bucket. It will prove of interest to those desiring a small capacity, well-built outfit.

American Sheet & Tin Plate Company, Pittsburgh.—8½ by 11 in., 22 pages. A reprint from the "Journal of Industrial and Engineering Chemistry" reporting researches on the corrosion resistance of coppered-steel. The article is by D. M. Buck, metallurgical engineer, American Sheet & Tin Plate Company and J. O. Handy, director of laboratories of the Pittsburgh Testing Laboratory Company, Pittsburgh, Pa. The synopsis of the conclusion indicates that the results of tests will probably be disputed by adherents of the pure-iron theory. The bulletin discusses, as readers of the Engineering Record well know, a highly controversial subject.

Foote Concrete Machinery Company, Chicago, Catalog No. 7, 7 x 10 in., 128 pages, illustrated. The opening pages picture various parts of the Foote plant. Following this is a description of the details of their five different sizes of en-discharge paving mixers and five sizes of side-discharge building mixers. This is accompanied by numerous illustrations of each type and of the arrangement of a railroad car plant. The remainder of the catalog shows photos of Foote mixers on the job, ending wth a set of dimension drawings of the different types of mixers together with their respective output and yardage tables.